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48120 May 1994

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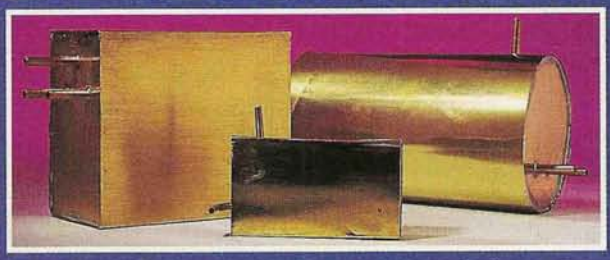

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MAY 1994 VOLUME 122, NUMBER 5

MODEL AIRPLANE NEWS

ABOVE: *at the '93 Superman Fan Fly, sponsored by Model Airplane News and JR Remote Control, Herve Serrano won Best Scale Finish with this T-33 (see article). Photo by Rich Uravitch.*

ON THE COVER: *Midwest's new, giant-scale AT-6 is big news. The plane has an 83-inch wingspan and is IMAA-legal. It also has laser-cut parts and many simplifying construction techniques, such as interlocking components. It uses a set of Robart retracts that can be bolted right in if you build the plane with fixed gear and then decide to upgrade. Tru-Turn also makes a special spinner for this ship (see "Air Scoop"). Photo by Dan Parsons.*

FEATURES

CONSTRUCTION

COLUMNS

DEPARTMENTS

Model Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.**, 251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates are: $27.95 for 1 year (foreign, $37.95); $49.95 for 2 years (foreign $69.95). **Postmaster:** send Form 3597 to **Model Airplane News,** P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

TOM ATWOOD

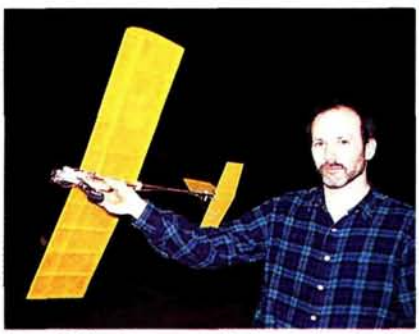
DESIGN CONTEST UPDATE

We are really excited by the high level of interest that has been expressed in the slow-flight design contest we are co-sponsoring with NASA Langley Research Center, the NACA/NASA Alumni Association and Shapery Gyronautics Corporation. We have been contacted by modelers from around the world and look forward to a very interesting competition. I assume that you've read my February and March editorials (in which contest rules were discussed), or seen the design contest ad that appears elsewhere in this issue. If you haven't, you'll be interested to know that over $6,000 in cash is being offered.

We will release a single, revised rule sheet that will include information from the prior "Editorials" as well as this one. Many have asked the same or similar questions, so I'll answer these here.

• ***K Factor.*** *What is the focus of the indoor electric class? Is it to spur the development of R/C craft that work well in a space the size of an indoor gymnasium? Will there be extra points, a "K" factor, for models that have a scale appearance or that show some ability to perform simple aerobatics?*

We do hope the contest will promote indoor, ultra-miniature R/C. We put no premium on scale appearance; we do not even require that the aircraft ROG or have landing gear (but an aircraft must be flyable after it has landed). Since our aim in starting the contest is to stimulate the creation of highly controllable, very slow-flying aircraft (in both the internal-combustion and electric classes), and since the overall performance envelope is of interest, the ability to perform loops, rolls, or other aerobatics could be used by the judges to determine, for example, which of two designs with equal slow-flight capability should get the edge. This means that if your aircraft can do simple aerobatics, you may wish to specify this and videotape it. The judges are not required to consider such aerobatics, but they may, if it helps to break a tie.



Russ Pribanic, a contributing writer for Model Airplane News shows off his latest indoor electric design—the Watt Jr. At right, the 3-channel plane performs a loop in a local high school gym. Created prior to the slow-flight design contest, Russ's plane, nonetheless, shows some avenues that could be pursued. The Watt Jr. has a 36-inch wingspan, an 8.5-inch chord, an area of 308 square inches and a wing loading of 5.09 ounces per square foot. (As a point of comparison, some of the remarkable indoor electrics that flew years ago at the Pasadena IMS Show had wing loadings of about 2.5 ounces.)

The plane uses two standard slot-car motors with a 7:1 gearbox that Russ designed. They're powered by an SR 5-cell 225mAh pack. The ship carries the new AstroFlight miniature speed controller and uses modified Astro connectors. The 10.9-ounce (ready-to-fly) plane is of balsa construction, and it's covered with Coverite micafilm. Pulling 6 amps (36 input watts), the ship flies for about 1.5 minutes. It's controlled by a Canon miniature radio powered by a 4-cell SR 50mAh battery pack. Photos by Tom Atwood.

• ***Wing minimum area mode and wing loading.*** *I have a question about wing loading as it relates to the internal-combustion engine "floater" (15 ounces per square foot or lower) and "conventional" (20 ounces per square foot or higher) classes. Is the following statement accurate? "Wing loading will be determined by dividing the weight (in ounces) by the wing area (in square feet) when the wing is in its minimum-area mode. 'Minimum-area mode' means that any flaps, slats, telescoping sections, etc., are all retracted for high-speed flight. Any fans embedded in the wing that exhaust vertically downward will be counted whether or not they are in operation, but such fans cannot exceed 60 percent of the area of the wing (or lifting body, or wing plus lifting body) when in the minimum-area mode."*

(Continued on page 132)

KERN RIVER BLADE RUNNERS' '94 HELICOPTER FUN FLY

The Kern River Blade Runners' annual West Coast R/C helicopter fun fly is scheduled to be held on April 29 through May 1 in Bakersfield, CA. There will be $5,000 in raffles and prizes and plenty of overnight RV parking and motel accommodations. The event, which is co-sponsored by Miniature Aircraft USA, has grown to be one of the largest and best R/C helicopter gatherings in the U.S., and the '94 Fun Fly should be the best yet. Approximately 120 pilots with around 250 helicopters are expected to converge on the Blade Runners' 80-acre cut-grass flying site for three days of day and night flying fun. This year, attendees will enjoy demonstrations by world-class U.S. and German pilots, as well as product displays, clinics and lots of fun-fly events (including helicopter pylon racing).

For an information package, contact CD Dave Dahl at (805) 392-8837. Watch for Elaine Jackson's coverage in a future issue of *Model Airplane News!*

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

ERRATA

In the February '94 issue, we published a review of the Custom R/C Aircraft YF-22. The number of Total Aerographic Services should have been (901) 386-7760. We apologize for any inconvenience.

ESTIMATING LEVEL SPEED

The "RPM" review of the Magnum Pro .36 SE ABC engine in the February '94 issue is one of the best such reviews I've read. Out of curiosity, I compared the straight speed figures with those given in the article I wrote on estimating level flight speeds (see nomogram on page 64 of that issue). The nomogram figures are obviously high.

Rather surprised by this comparison, I calculated the gain in revolutions from static to in-flight modes. The gain for higher-pitch props was very low.

In comparing the advance per revolution to the propellers' nominal pitch, the advance per rev (in contrast with previous "RPM" articles), was less than the nominal pitch, except for a couple of the lower-pitch props. In a loop, the advance decreased considerably.

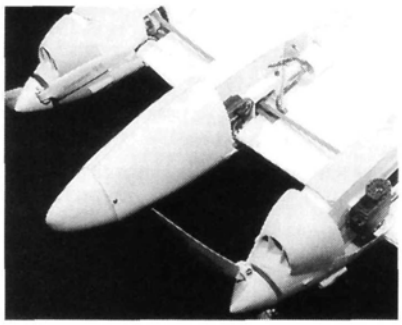
Next, the Airtrax 40 flight test aircraft was considered. The power loading at 5.75 pounds [92 ounces] was 255.5 ounces per cubic inch displacement—not unusually high.

Judging from the photo in *Model Airplane News*, this model is fairly large for a .36ci engine, and the drag must be high. The figures all seem to indicate that something is holding the model back. Drag can be the only culprit causing these variations.

ANDY LENNON
D.D.O., Quebec, Canada

Thanks for your comments, Andy. We've received a few inquiries about the discrepancy noted. As most will acknowledge, predicting the behavior of models—given variations in propellers, engines and airframes—is not an exact science. Writers such as you and Dave Gierke are helping us move forward toward a clearer understanding of our models. We are grateful for your and Dave's help and will continue to bring your contributions, and those of others at the forefront of the hobby, to our readers.

TA



BELT-DRIVE EFFICIENCIES

In his coverage of the KRC Electric Fly '93 in the January '94 issue, Bill Griggs wrote about Bob Kress's P-38 Lightning. It's a fun-scale plane with an AstroFlight cobalt 035 motor that drives twin props. I'd like more information on how his idea was made to work and the parts he used. I'm ready to start building a P-38 with a belt drive—at least, I have it in mind, but I don't know how to start or which parts I need.

GENE MANNO
Williamson, NY

Gene, Bob Kress patented his belt-drive system in the early '80s. In an experiment to test the system, he first flew a B-17 (a modified Sterling kit) powered by a TD .049 that spun all four props. Much to Bob's surprise (and that of pilot Nick Ziroli Sr.), the 42-ounce plane "flew like crazy" on that engine. That system had a master toothed-belt wheel (all Bob's designs use toothed belts) that was mounted directly on the TD .049's drive shaft. A pulley on the drive shaft had on the order of 10 to 14 teeth. Bob uses 0.080-inch pitch pulleys (the number refers to the distance between the teeth). He says this is a light pulley but appropriate for

smaller models. Bob's description of his belt-drive system follows:

"Both belts run off the same pulley, which is wide enough to accommodate two belts. One goes out to the right-hand prop and one to the left-hand prop. The prop pulleys are larger, on the order of 30 teeth, so your gearing can be anywhere from 2:1 to 4:1, depending on what you want to achieve with your model. Since you can adjust the gearing, this system offers an interesting capability: you can match the scale diameter of the props to the model quite easily. Incidentally, if you use Electro Flight Design, you'll also be able to match the number of blades on the scale propellers. [Editor's note: Electro Flight Design is an electric model airplane design program designed by Bob Kress, written by John Kress and sold by Kress Jets.] The program can also be quite easily used to mimic a gas or glow engine.

"You can similarly make a four- or six-engine model, simply by looping additional belts from one motor to the next outboard motor. The pulleys, the belts, the precision shafting, the bearings and everything else needed can be obtained from Stock Drive Products. However, if you wish to obtain a complete drive system for a particular model, you can contact us directly at Kress Jets, 4308 Ulster Landing Rd., Saugerties, NY 12477; (914) 336-8149.

"If you set these belts up right, you can have an essentially infinite life, i.e., they would not be expected to wear out over the lifetime of a model (the mice will get them first). Belt drives allow you to match the propeller very much better to the model than do direct drive systems. Moreover, when you spread the power over multiple propellers, it is a much more efficient system, since you are running props that are of larger diameter and of optimal pitch, and this gives you greater thrust and longer flights."

Our thanks to Bob Kress for the information. Readers can reach Stock Drive Products at 2101 Jericho Tpke., New Hyde Park, NY 11040; (516) 328-3300.

(Continued on page 120)

THE GREAT

R/C SLOW-FLIGHT DESIGN CONTEST

MODEL AIRPLANE NEWS · NASA · Shapery Gyronautics Corporation

Co-sponsored by MODEL AIRPLANE NEWS, NASA Langley Research Center, the NACA/NASA Alumni Assoc. and Shapery Gyronautics Corp.

CASH PRIZES IN THREE CLASSES!

CLASS A	CLASS B	CLASS C
Internal combustion "Floaters"	Internal Combustion "Conventional aircraft"	Indoor Electric
1st–$1,000	1st–$1,500	1st–$1000
2nd–$500	2nd–$825	2nd–$500
3rd–$250	3rd–$425	3rd–$250

Designed to spur development of practical low-speed flight capability—slow-flight performance and innovative design.

Winners will receive cash and award certificates signed by famous aviation pioneers, and their designs will be published in *Model Airplane News.*

Contest runs from January 1, 1994 to December 31, 1994.

Entries evaluated by committee of NACA alumni and NASA design engineers.

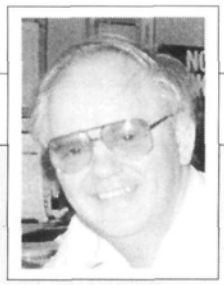
Awards presented in early 1995 at Virginia Air and Space Center in Hampton, VA.

■ **Class A**—Wing loadings of 15 oz. per sq. ft or less.
■ **Class B**—Wing loadings of 20 oz. per sq. ft. or more.
Classes A and B must have total displacement of between .40 and .50ci, irrespective of the number of engines. Additional electric propulsion is allowed. Slow-flight time trials will be held outdoors along a 100-foot strip no more than 20 feet wide.
■ **Class C**—Must be powered by electric motors running on commercially available Ni-Cd batteries; must fly at least twice around perimeter of regulation-size (professional) indoor basketball court on one charge and do a figure-8 within the court (not necessarily on same run as the laps). Slow flight will be measured separately along a 15-foot wide, 50-foot course.

BE PREPARED!
■ *Entrants will provide:* three-view; aircraft specs. (including a statement of performance); description of design (two typed pages, or less); still photos of aircraft; letter signed by CD and local club president; videotape of flight tests. Flight tests will be conducted locally by R/C clubs under the honor system and under applicable AMA safety guidelines.
■ *Winners will submit (and will be paid separately for):* construction article, including workable draft of full-size plans, black-and-white construction photos, construction steps, color slides of the model on ground and airborne.
■ For rules, contact Julie Soriano, Managing Editor, *Model Airplane News,* 251 Danbury Rd., Wilton, CT 06897. Have specific questions? Contact Tom Atwood at (203) 834-2900; fax (203) 762-9803; Internet: toma@airage.com.

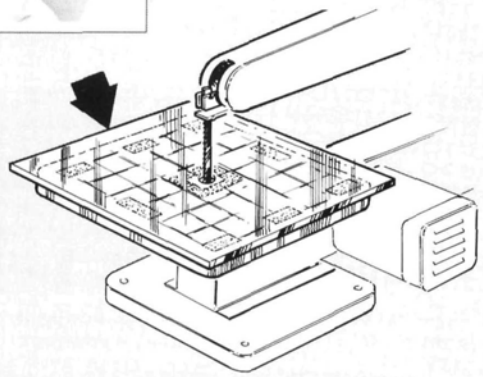
We hope this inspires you!

HINTS & KINKS



JIM NEWMAN

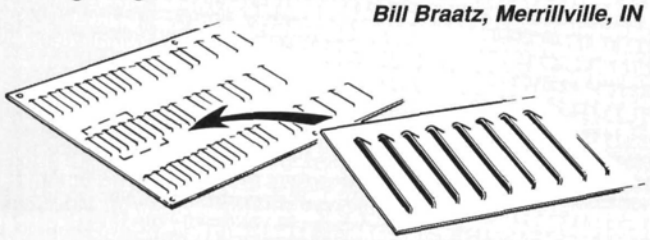
Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



A SLICKER SAW TABLE

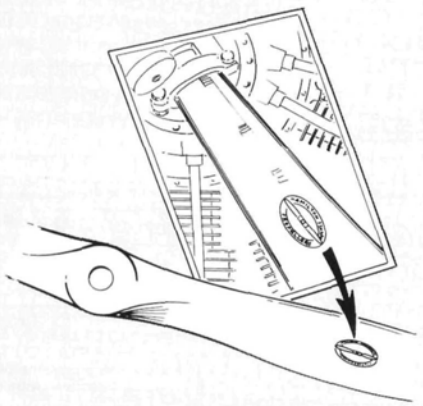
The grooves that many saw tables have in their surfaces can make working with small parts difficult. To create a smooth surface, cut a square of the appropriate size out of Plexiglas or Lexan, and drill a hole in the center for the blade. Double-stick tape placed at the edges of the plastic and around the hole will secure it and prevent sawdust from getting in between the two surfaces.

Bill Braatz, Merrillville, IN



READY-MADE LOUVERS

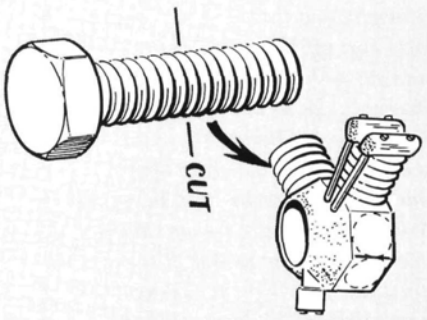
Plastic attic vents have many small louvers, and they're ideal for an SE 5a or a Fokker D-VII. Made of thin vinyl, these vents are tough and scale-looking, and they only cost about $3.75 apiece. ***Edward Hillen, Mastic, NY***



MINI PROPELLER LOGOS

Photograph a propeller logo at your local airport; then photocopy it in the size you need. Before you cut it out and glue it to the blade, color it with permanent markers. (If you have access to a color copier, you can skip this step.) Fuelproof the logo with clear urethane or epoxy.

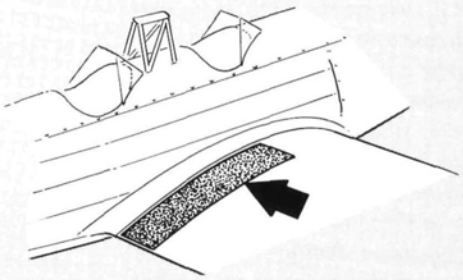
John Sunyak, Parma Heights, OH



SMALL MODEL DUMMY CYLINDERS

Some very small scale models are being built nowadays. To make dummy cylinders for them, cut the head off a black nylon screw, and attach the threaded portion to a balsa crankcase. Dress it up with aluminum wire or tubes and balsa-block rocker boxes. For larger models, you could use black, plastic, plumbing fittings.

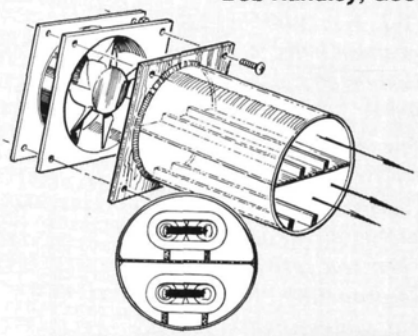
Jay Wallace, Ashland, OR



REALISTIC WALKWAYS

To create walkways for your plane's wings, cut out strips of black emery paper, then glue them to the wings with a smear of PFM. Walkways are rough! Use 150 grit for .40 to .60 size, and 60 grit for larger models.

Bob Handley, Goodyear, AZ



NI-CD COOLING TUNNEL

Great for electric-powered models, this tunnel is made out of a plastic soft-drink bottle that has been glued into a hole made in a ⅛-inch-thick plywood plate. Using screws, mount a small 12V cooling fan on the plate. (These fans are available at electronics stores for about $10.) The fan draws less than 250mA, and it can be safely operated using a car battery. A 1/16-inch-thick plywood deck and some balsa rails hold the packs and allow the air to circulate. ***Marc Arys, Machelen, Belgium***

PRODUCT REVIEW

CONTACT! FROM 1,000RPM TO 21,000RPM, THIS REVOLUTIONARY IGNITION SYSTEM FIRES ON DEMAND

ProSpark Onboard Electronic Ignition

by ROB WOOD

The ProSpark unit is shown in its metal case. ProSpark units for smaller glow engines are shrink-wrapped and more compact.

FOUR YEARS AGO, Ron Chapman (original designer of the Aerrow* giant-scale engines) had a problem: his modified chain-saw engine was interfering with his PCM radio. The slop in the mechanical advance ignition was creating radio-frequency "noise" that caused the signal from the transmitter to break up before his receiver could recognize it. Being a good little PCM receiver, it did what PCM receivers do: it shut itself off. The interesting thing was that the airplane never crashed. The interference was constant, but it pulsed in a way that gave control back to the receiver—and then took it away—every couple of seconds. This performance resulted in sluggish response and a major headache for Ron. He contacted Duarte Cabral and asked whether he could solve the problem. Duarte, an electronics engineer with expertise in the design, manufacture and troubleshooting of computer chips, applied these skills to the task. After four years of tinkering and R&D, the ProSpark* electronic ignition was born.

This small spark plug is screwed right into the glow-plug receptacle.

I first discovered ProSpark at the 1993 Madera Unlimited races. My Webra* prototype 4.4 racing engine wasn't running at anywhere near peak efficiency. I knew the engine should have been swinging its 20x16 APC* prop faster than 7,600rpm, but despite having tried a variety of glow plugs, nitro levels, oil mixtures, etc., the engine refused to turn any faster. Duarte Cabral sought me out and offered to install one of his units on my engine, just to see what it would do. I figured I had nothing to lose, so I agreed.

Converting from glow to ignition turned out to be a simple affair: he simply drilled a hole in the hub for the magnet and glued the Hall sensor bracket (which senses the passage of the magnet) to the case. After wrapping the small metal housing for the circuitry in foam, he secured the housing to the airframe and plugged in the small Ni-Cd battery. All that was left to deal with was the spark plug. What could have been a major undertaking involving a local machine shop was made simple by using a miniature NGK spark plug, which Duarte screwed right into the ¼-32 threaded glow-plug socket. The NGK even accommodates the same glow-plug wrench!

A small hole is drilled in the thrust washer on the author's racing Webra 4.4 engine. A supplied magnet is press-fit into this hole. The Hall sensor has been clamped into place nearby.

Then came the final step. We fueled the airplane and flipped the prop—instant ignition! After running the engine up to full throttle, we took a tachometer reading: 8,500rpm! Using 8 percent nitro and a spark plug (versus 25 percent nitro and three glow plugs), we had gained 900rpm. After running the engine for a few minutes, we decided to shut it down and refuel. Unfortunately, we had neglected to adjust the butterfly valve in the carburetor so that it would fully close, and the engine kept running with the ProSpark unit functioning—at 1,000rpm. That's a pretty slow idle for a racing engine of this type.

If this article sounds like a promo for ProSpark, it's only because I've never seen anything like this ignition system, and since Madera, we have installed the unit in a 5.9 Webra and a 198cc Aerrow 200RS, with basically the same results.

The unit has since been installed in several other types of engine, and from the reports I've heard, it has performed flawlessly.

• **3W.** Dave Johnson of Desert Aircraft*, which distributes 3W, has installed a unit in

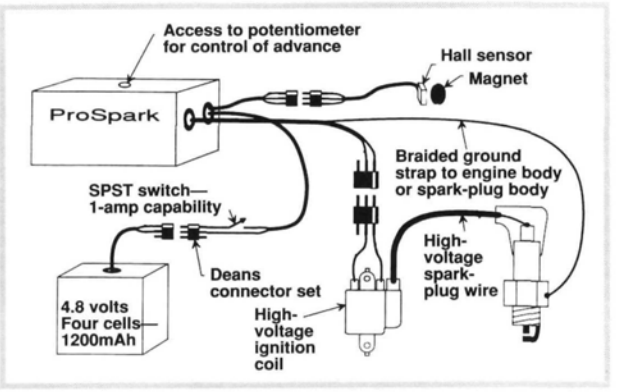
one of his engines and now claims smoother throttle response and a 1,000rpm idle. He has sent a second unit to Germany for approval.

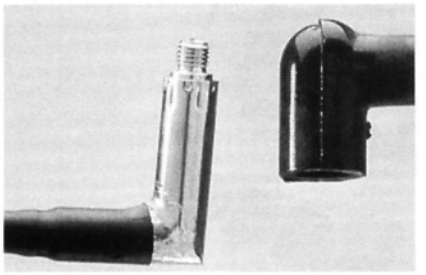
• **Aerrow.** Klaus Nowak has installed a unit in an Aerrow 200 and has reported no loss of power (as compared with a a competitive mechanical advance) throughout the throttle range.

• **Lake Hobbies*.** John Pearson installed a twin unit on his 3.6 Moki* in-line, firing two spark plugs simultaneously, twice per revolution. At 10,000rpm, the ProSpark ignition is firing at 20,000rpm! John has run the engine for 20 hours, attempting to push the unit to failure. So far, John has failed, even when running 40 percent nitro! (See sidebar.)

• **Webra.** Randy Villines states that ProSpark has revolutionized the state of the art of model aircraft engine performance. He has installed the unit in his new TOC engine and has designed the production run to accommodate ProSpark.

• **Robart*.** Bob Walker has installed a customized ProSpark unit in his awesome 7-cylinder radial engine. The unit has a distributor with seven magnets at the base, and it fires 31/2 times per revolution for a total of 21,000 firings per minute!





ProSpark gives you a choice of spark-plug adapters for glow or large gas engines.

PROSPARK'S UNIQUE FEATURES

What makes the ProSpark different from other ignition systems? Duarte Cabral has designed his own integrated circuitry, and he uses military-spec parts and materials. There are no moving parts. The firing charge of the capacitor is 250 volts, which is sustained throughout the throttle range. That means that the spark is "clean" and strong from idle to full throttle. By installing an adjustable control oscillator, Duarte experimented with different settings until he eliminated radio-frequency noise. The unit doesn't need shielding on the spark-plug lead.

The electronic advance is user-adjustable. By inserting a non-metallic screwdriver into a slot in the "pot," the advance can be fine-tuned from 22 degrees to 38 degrees while the engine is running. It would be a simple matter to adjust the advance remotely with a servo. This feature allows the user to set the optimum timing for each application.

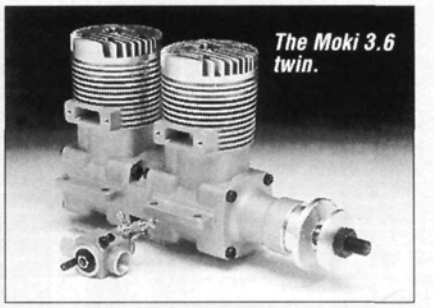
The "intelligent" circuitry of the ProSpark unit remembers top dead center (TDC) of each revolution of the prop, and it "thinks" 1,000 times faster than necessary at full throttle. Therefore, the unit spends most of its time waiting for TDC instead of lagging behind at high rpm. As a result of this built-in anticipation, the plug fires on demand, even when it's rammed from idle to full throttle. The unit begins to advance at 3,000rpm and continues smoothly up to 21,000rpm. When the piston reaches the predetermined firing angle for the current engine speed, the spark plug is fired and within 1 millisecond, the flame front has traversed the combustion chamber and ignition has occurred. I have a hard time imagining 1/1000 second (much less a nanosecond), but what it boils down to is that the ProSpark unit can fire the plug unerringly from 0 to 21,000rpm in one revolution of the prop! Of course, it's a physical impossibility to throttle up that quickly, but it's nice to know that the unit can't be fooled.

FLIGHT TESTING

Of course, running these tests on the bench is one thing, but how does the unit perform in flight? Duarte wasn't ready to produce these units for unlimited racing without covering all of his bets:

• To deal with high temperature, the integrated circuit is military spec (just as with the cruise and Patriot missiles)—minus 40 degrees to plus 150 degrees Celsius.

(Continued on page 85)



The Moki 3.6 twin.

From Broken Crankshafts to Success

by JOHN PEARSON

During the winter last year, the old competition bug bit me. The bug was induced by my brother calling me from Southern California and informing me that he had just pulled an extra P-51 fuselage from the mold. I had crewed for him on race number 96 at the previous two Madera Unlimited races. Within a few weeks, the shipping company showed up at the front door with three huge boxes containing a fuselage, wing-cores and a completed tail section.

I decided to enter both the AT6 and the Unlimited classes, so the next seven months were spent building and testing the AT6 and P-51. The P-51 was going to be powered by one of the two Moki 3.6 twins that I had on the shelf. With tuned pipes installed, we started break in of one of the new engines. The crankshaft broke behind the front counter weight after approximately one hour of running time. The engine was sent next-day air to Jim Gerard, the Moki man. I have to commend Jim, as the engine was repaired and arrived at my place almost before I got back from UPS. We were informed that the Moki twin was designed as a sport engine and might not be suitable for racing. An engine change with race day almost upon us would not be possible. The P-51 was scratched for the 1993 Unlimited race at Madera.

While at the race in early October, I purchased a ProSpark electronic advance ignition. Upon my return home, I got together with a machinist friend, and we tried to define what was causing the Moki crankshaft problem.

We surmised that the in-line twin's rear cylinder would run at a higher temperature than the front cylinder would. Because it's a glow-plug engine, we assumed that the temperature would increase in the rear cylinder more quickly than in the front. This condition would cause the rear cylinder to fire at a more advanced position than that of the front. This change in timing between the front and back cylinder was causing a bucking action and, in turn, was breaking the crank. My friend went to his machine shop and built a set of rings to hold the ProSpark Hall sensor and magnets.

The testing was almost textbook with the exception of finding the proper spark timing. After many tries, the timing ended up between 23 and 25 degrees before top dead center. After more than 20 hours of running (most of which was wide open and some with nitro), the results seem to prove our bucking theory. The best configuration we used was an APC 18x18 that was turning at just under 10,000rpm. We found the ProSpark to work very well even under the handicap of having to fire twice for each revolution. The Moki 3.6 twin with ignition is still a competitive engine and shouldn't be overlooked in unlimited racing.

AIR SCOOP

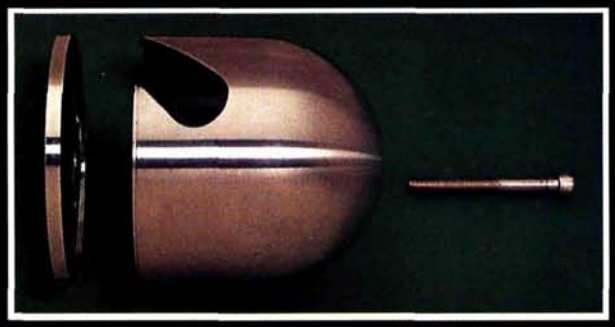
CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Early training

New Domes

Those precision spinner manufacturers from Tru-Turn have added two new sizes—a 2¾ inch and a 4 inch—to their dome-spinner repertoire. With the already popular 3¼-inch AT-6 spinner, the Tru-Turn Domes should now cover almost any scale needed—be it a Staggerwing, a Stearman, or a Texan. Incidentally, the 2¾-inch one is just right for the new 83-inch-span Midwest AT-6. Contact Tru-Turn Precision Model Products, P.O. Box 836, South Houston, TX 77587; (713) 943-1867.



BREAKTHROUGH

When computer radios first arrived on the market, manufacturers seemed to be of the mindset that more is better. As far as the "egg-headed" modeler was concerned, they were correct. Now, some of those manufacturers are realizing that many other modelers, while wanting the convenience and control afforded by these radios, don't wish to read a phone-book-size manual to fly on Sunday. With the arrival of the XF622, it's obvious that JR concurs. The XF622 stands for FM only, six channels, two-model memory and two modes (airplane and helicopter). It's a full-feature computer radio that has all the basics you'd expect, plus some of the unexpected, such as a "credit card" 266 FM receiver and a flight-mode "wild and mild" switch that changes the dual rate on both aileron and elevator. For helis you can combine throttle curve, pitch curve, dual rates, gyro sensitivity and revolution mix point. Not bad when you consider the XF622 will probably be obtainable for a "street price" of under $250. Look for a full review on the system in a future installment of *Simple Programming* by Dave "Lord Admiral" Baron. For information, contact JR Remote Control, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.

IN SEARCH OF...

For you YS 1.20 lovers out there who have been searching for an in-cowl muffler specifically designed for this fine engine; the search is over! Slimline USA now offers a Pitts-style muffler that features a short-stack header that screws directly into the YS head. The muffler clamps onto the steel header, and the exhaust end of the muffler is bolted onto the motor-mount beam with the included bracket. The installation is very simple and requires no drilling, bending or other modification. This muffler will also be available for other 4-strokers and will come with a pressure fitting for non-pumped engines. Smoker versions are in the works, too. Thank you, Slimline!

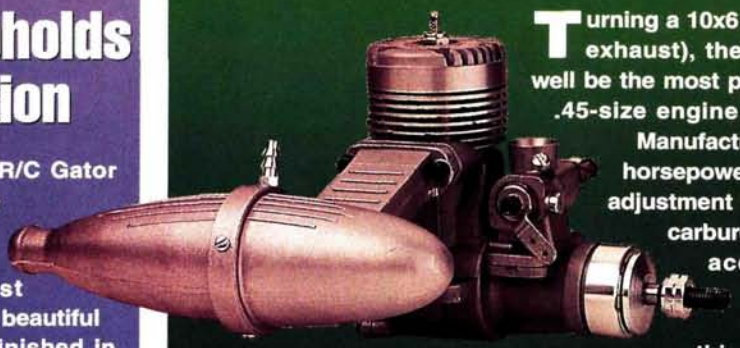
For further information, contact Slimline USA, P.O. Box 3295, Scottsdale, AZ 85257; (602) 967-5053; fax: (602) 967-5030.

The "Air" Apparent Upholds the Tradition

At the First Annual R/C Gator Invitational Scale Shootout held at R/C World in Orlando, FL, Nick Ziroli Jr. took first place in Expert with his beautiful Grumman F6F Hellcat finished in unique Royal Navy colors. This 96-inch-span (2¼ inches to the foot) built from Ziroli plans uses an Airtronics Vision radio for guidance and a Sachs 5.2 for gusto. While Nicky trailed three points behind the

static score leader, he wowed the crowd with four fantastic flights—two of which were the overall highest scoring flights of the contest—parlaying his way well into first place in gusty, high, Florida winds! He's some pilot! Like his father, Nick Sr., Nicky is not only a fine craftsman, but he's also a good sport. He also took home the Sportsmanship award for the event. As you read this, Nicky should be delivering his fiberglass fuselage, cowl and canopy for the F6F, which will be followed by glass components for the 94-inch-span Ziroli P-40. For more information, contact Nick Ziroli Models, 29 Edgar Dr., Smithtown, NY 11787. Phone: (516) 234-7264.

FRIENDLY POWER



Turning a 10x6 prop at 14,800rpm (open exhaust), the new .46BB ABC could well be the most powerful sport R/C .40- to .45-size engine ever produced by Fox Manufacturing. To manage all this horsepower, the new single-needle adjustment "Ultra" EZ, air-bleed-idle carburetor has been fitted and, according to Fox, gives excellent throttle transition. Other features of this 13-ounce robustly built engine are true ABC piston/sleeve technology plus extra-strong crankshaft and connecting-rod construction. A 2-inch-diameter, cast-aluminum spinner and muffler are included. Stay tuned to "Scoop" for more Fox Manufacturing updates.

Gee Bee BY BYRON

A ¼-scale Gee Bee R-2 and Byron Originals seem to be such a natural pair that you wonder why they didn't do it sooner. I guess it's a case of so many subjects and so little time. Rumor has it the new R-2 may feature a conventional built-up balsa wing with wingspan options: 80 inches, for IMAA rules; or 75 inches, with two inner wing bays removed, for exact ¼-scale dimensions. More in line with familiar Byron practices, each kit features a fiberglass fuselage, wheel pants, gear-cuffs and cowl. The 56-inch-long, 23- to 24-pound R-2 calls for a G-62, Precision Eagle 4.2, or Sachs 4.2 engine, or similar. Reports are that the prototype flies like a dream while having an imposing presence on the ground and in the air.

PHOTO BY BOB WOOD

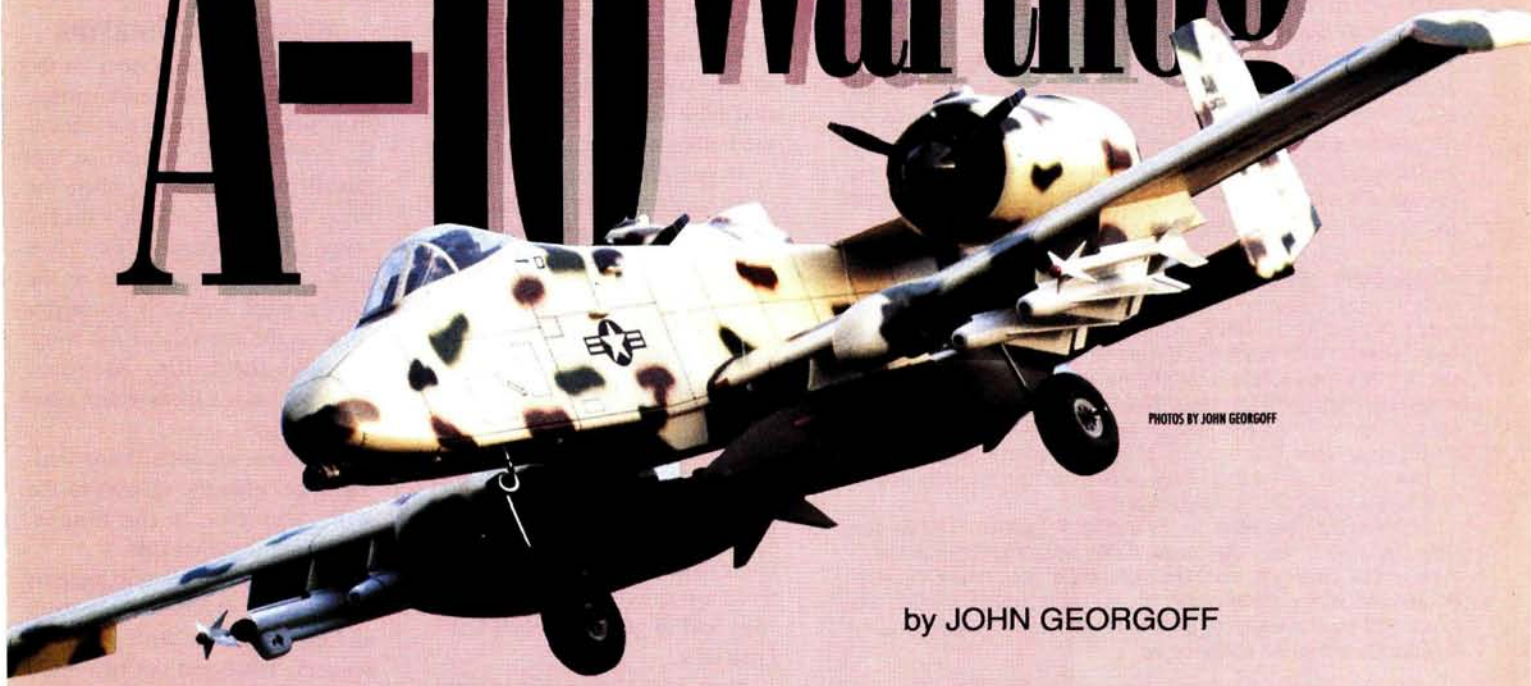
Instant Porter

That turbo-propped, STOL-capable, modern-day German Fieseler Storch, flying Swiss "aardvark" known as the Pilatus Porter will soon be available in ARF form from EZ OK Model Co. Ltd. All I can tell you about the new offering at this point is that its wingspan is approximately 77 inches, and it's specifically designed for an .80 to .90 4-stroke engine. As usual, the Takamatsu father and son team is sure do do a beautiful job producing this new kit.

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

A semi-scale Sunday tank-buster

A-10 Warthog



PHOTOS BY JOHN GEORGOFF

by JOHN GEORGOFF

IN BATTLE CREEK, MI, the A-10s fly a daily routine from the Air National Guard base, and I thought it would be nice to fly one of my own. I wanted something that would be easy to transport (so I didn't want anything too big) and big enough to be versatile.

I began by building a 1/48-scale plastic A-10 model. Then one of the members of my local R/C flying club who's a machinist at the base invited me there to take a closer look at the "real" thing. This really helped with both the construction and the detailing.

SPECIFICATIONS

Wingspan: 48 in.
Weight: 5 ½ lb.
Length: 44 in.
No. of channels req'd: 4 (throttle, aileron, elevator, nose-wheel steering; rudder is optional)
Airfoil type: Clark Y
Wing construction: foam, balsa and plywood
Fuse construction: balsa and plywood
Wing area: 408 sq. in.
Wing loading: 31 oz. per sq.ft.
Engines req'd: two .15 to .25 2-strokes
Prop used: Zinger 8x6
Washout built into wing?: yes
Comments: This model has simplified construction and good scale appearance. Regular model engines save you money!

WING CONSTRUCTION

The wings are made of Styrofoam, plywood and balsa. To cut all the foam wing-cores, it takes three rib templates: two of the same size for the center section, and a third (the tip) that's ¾ inch shorter to complete the outer panels. Put the two longer templates at each end of the center section. Next, to hold the templates in place, drill a hole in the front and back of the templates and run a 1-inch screw through the ribs and into the foam. (The templates are made of ⅛-inch-thick plywood.)

FLIGHT PERFORMANCE

My 5.5-pound prototype has a rather high wing loading for a model with a 48-inch wingspan. Be sure to build it as light as possible without sacrificing strength. Covering the model with film instead of painting it will really help. The lighter the model is, the better it will perform. Two very hot K&B 3.5cc (21ci) high-output ducted-fan engines with tuned pipes turn Zinger 8x6 props. The model is overpowered and very fast. If built to an all-up weight of 4 to 4½ pounds, the model will be much easier to fly, and less powerful (also lighter) engines could be used.*

• Takeoff and landing

With its tricycle landing gear, the model handles very well on the ground, and it taxies easily, even though the prototype does not have rudders. With two 3.5cc ducted-fan engines pushing, takeoff roll is quick, and I hold in a little down-elevator to prevent the model from lifting off too soon. When you have enough air speed, ease off the down-elevator, and the model will start to get very light on the gear; then just a touch of up, and you're on your way. Remember that, if you don't have rudders to keep it on the deck a little longer to maintain directional control.

When landing the Warthog, fly a long, flat pattern, and as you raise the nose to slow the model down, keep some power on to avoid a stall. When you make the threshold of the runway, cut your throttle and let the model settle; do *not* try to stretch the flair too much until you have a lot of time on the model and you know how it performs behind the power curve.

• High-speed performance

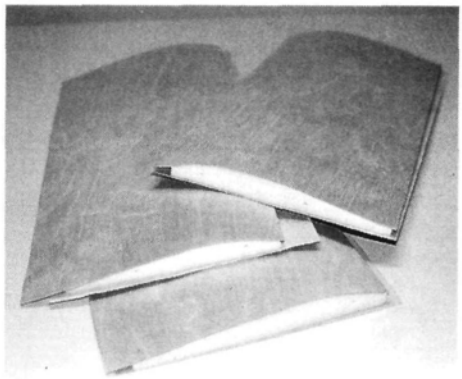
With its high-aspect-ratio wing (for a jet), the A-10 is not as fast as your typical jet model. It *is* fast though, and with a wing loading of 31 ounces per square foot, the model is most happy at the upper end of the speed envelope. The Warthog climbs very well, and you can get up to recon altitude very quickly. Pitch trim changes very little from slow speeds to high speeds.

• Low-speed performance

At slower speeds, control response is reduced but remains positive. At very slow speeds, such as when going around the landing pattern, some up-elevator trim will help minimize the descent rate, and some throttle will be needed. With so much attached to the underside of the wing, the model has a lot of drag, and power is needed to overcome this. It's here in the slow-speed area that you will most miss not having rudders. You should avoid slamming the controls around, because full aileron applied when the wing is not level can produce a tip-stall. Gain altitude before you explore the model's lower-speed characteristics, so you can feel it out. If you lose one engine, get the nose down to maintain air speed, and quickly land to check what happened. With a single fuel source for both engines, if one signs off, the other may be ready to follow.

• Aerobatics

The model will easily do everything in the book that can be done with aileron and elevator. Loops should be done with a fair amount of speed and only enough elevator to make a nice round maneuver. Too little speed or too much elevator will stall the model and introduce a situation of falling far behind the power curve, and a snap might be the result. Rolls are fast, but not completely axial; inverted flight needs some down-elevator trim.



The foam wing is made in three panels: a flat center section and two tapered outer wing panels. The foam-cores are covered with thin plywood.

length of masking tape on the wing skins about 1 inch away from the edges that I'm sanding to protect the 1/64-inch plywood from being scuffed by the sanding block.)

Run a hot wire across the tops of the ribs from the leading edge to the trailing edge, making sure that both ends of the wire reach the trailing edge at the same time.

If you don't want to cut your own cores, have them custom-made by Wing Mfg. Co.*; just send them the templates and the wing plans.

Cut the 1/64-inch plywood skins about 1/4 inch larger all around than is called for on the plans, then attach the skins to the cores. (I used 3M's Super 77 spray adhesive.) Spray both surfaces to be bonded, and wait 30 seconds before attaching the skins. When using this spray, you're advised to wear a respirator with a canister filter and to work in a well-ventilated area.

Next, trim all the sheeting and, using 80-grit sandpaper, sand all the leading and trailing edges and the ends flush with the foam. Lay the center section of the wing flat on the table, then put a 1-inch block at the end of each wingtip to get the dihedral needed to join the wing pieces. Sand the correct angle into the center section, and join all three cores with 15-minute epoxy. Install the 1/4x1/2-inch leading edges and the 1/4x1/4-inch trailing edges. (When sanding the leading and trailing edges, I always put a

AILERONS & WINGTIPS

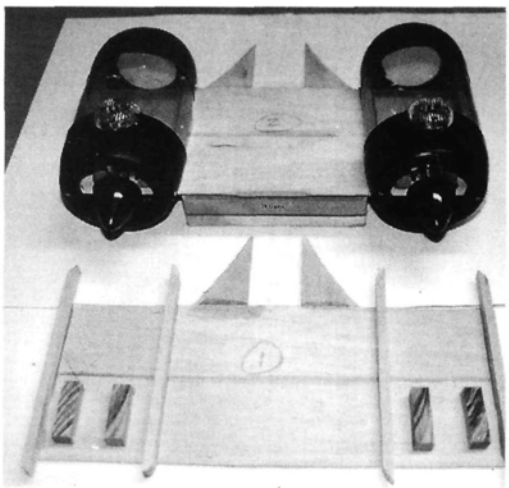
Cut the trailing-edge stock to the length specified on the blueprints, then notch and groove the stationary trailing-edge section so that the aileron torque wire, where the brass tubes lie, is flush with the wing trailing-edge stock. Then tack-glue the brass tubes in the trailing edge. Next, lay a straightedge on the top side of the wing, and glue the trailing edge into place so that it's flush with the top of the wing.

Slot the ailerons and wing trailing edge, glue the aileron to the wire, and glue in the hinges. Repeat for the other side.

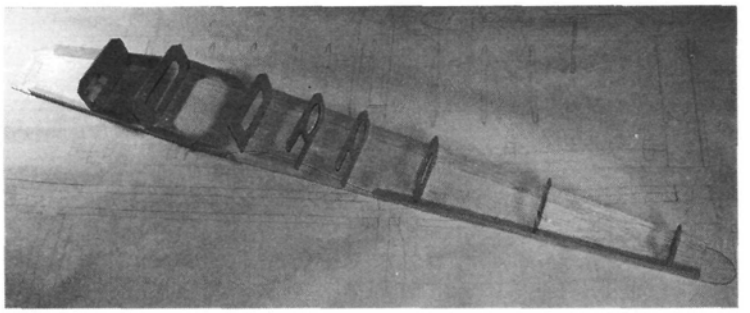
Trace the two wingtip patterns onto a piece of 1/32-inch plywood and cut them out with a pair of scissors. Trace and cut two more out of a piece of 1/4x2-inch balsa. When gluing the balsa flairs to the plywood, make sure that the balsa ends up toward the outer end of the wing.

WHEEL PODS

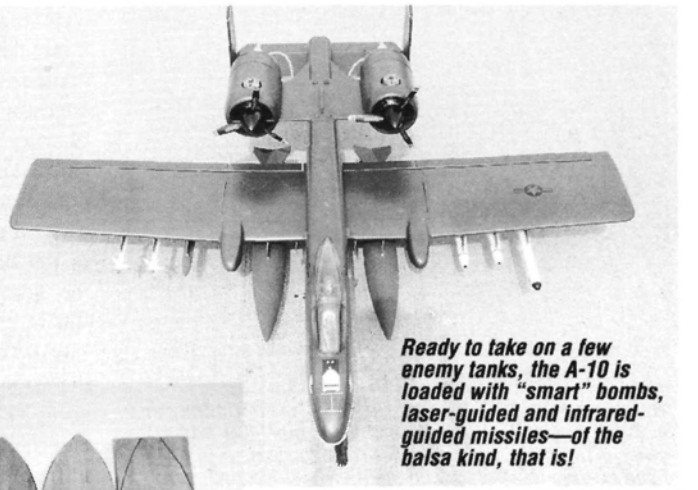
Start by tracing the wheel pod's side view onto two 2x2x11-inch balsa blocks, and then cut them



Here are the parts for the twin-engine-pod support platform. Made out of 1/4-inch-thick basswood, the support is reinforced with fiberglass and epoxy.



Here, all the fuselage formers have been installed—all made of ⅛-inch-thick plywood.



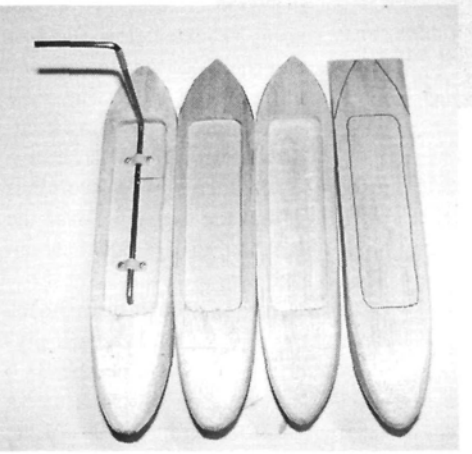
Ready to take on a few enemy tanks, the A-10 is loaded with "smart" bombs, laser-guided and infrared-guided missiles—of the balsa kind, that is!

out on a scroll saw. Trace the pod's bottom view onto the blocks' bottoms, and cut them to shape again. On the bottom surface of the pod, rout out a ¼-inch-deep slot and glue a piece of ⅛-inch-thick plywood into it. This plywood plate supports the landing-gear wire. (I routed out the material with a Dremel* tool and a milling bit.) Sand the pods to a bullet shape, leaving their bottoms a little flat, and bend the landing gear according to the plans.

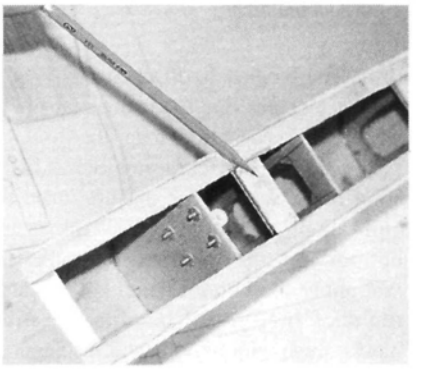
FUSELAGE

For the fuselage, use 2⅛x4x42-inch balsa sheets. Following a template, cut out the two sides and glue ½-inch triangle stock to the corners of the fuselage.

Then, using ⅛-inch plywood, assemble bulkheads 1 through 8. Before installing bulkhead 1, be sure to mount the nose-gear mounting bracket

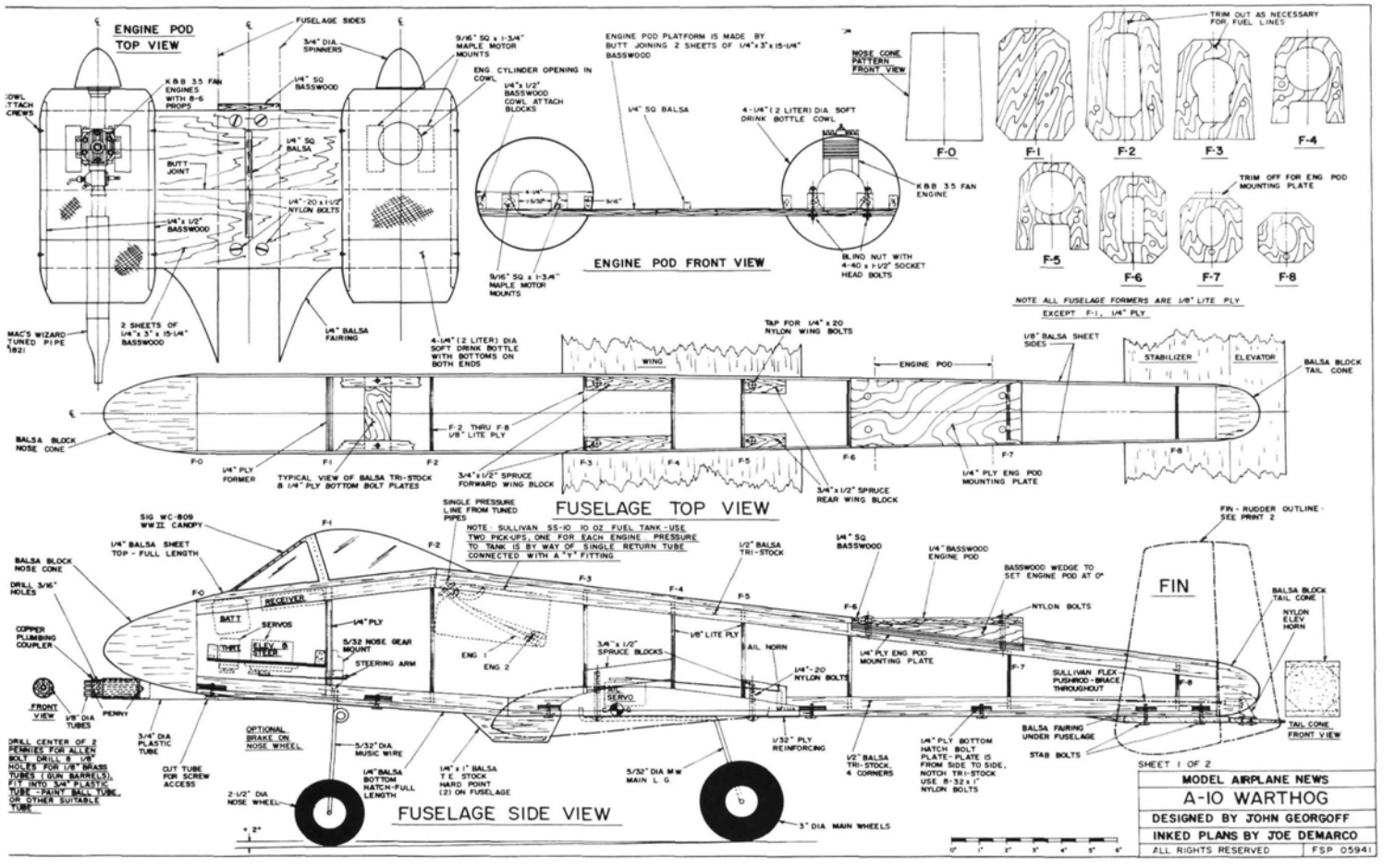


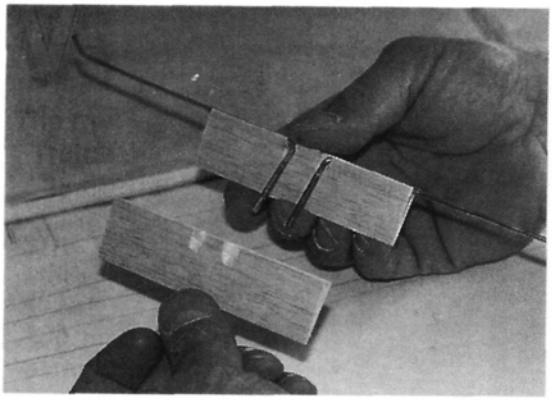
From right to left, the photo shows the steps followed to install the landing-gear-wire mounting plate in the wheel-pod block. The plate is made of ⅛-inch-thick plywood.



The fuselage bottom will be covered with three large hatch covers, so it will be easy to access the innards. Notice the plywood plates to which the hatches will be screwed.

ORDER THE FULL-SIZE PLAN...PAGE 110...FSP05941...$15.





The wing center section has a fixed trailing edge, and within the trailing edge are the torque tube and wire aileron linkage. Here, you can see that the prototype's fixed trailing edge was a lot smaller than the final version shown on the plans.

to it. The bracket is offset ¼ inch from the former's center line to ensure that the front wheel will be centered under the fuselage.

The 3½x2¾x4-inch nose block is made of solid balsa. Make sure that the nose block and tail block stick out past the fuselage bottom and top by at least ¼ inch. When you apply the bottom hatch covers and the top sheeting, you'll be able to sand the blocks flush with the finished fuselage.

Next, sheet the top of the fuselage, starting at the nose block. Sheet the area from the rear of the engine mount to the back of the tail cone, and glue the bottom hatch hold-downs to the areas indicated on the plans.

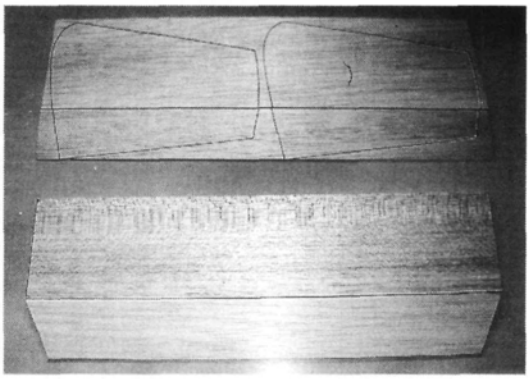
Next, sand the nose block to fair it into the top fuselage sheeting, and sand the tail block and the top edges of the sheeting. The fuselage bottom hatch covers are made in three sections: a front section between the nose block and the wing; a middle section that's glued to the bottom of the wing; and a rear section that's bolted on behind the wing. Use plastic screws to install the hatch covers. Then cut the wing cradle down to bring the wing ⅛ inch below the front and back hatch covers and allow the use of foam tape in the wing cradle.

Next, install the wing hold-down blocks, which are made of ¾x½-inch spruce (see plans for details). Place the wing over the hold-downs, and drill and tap for ¼-20x2 plastic screws.

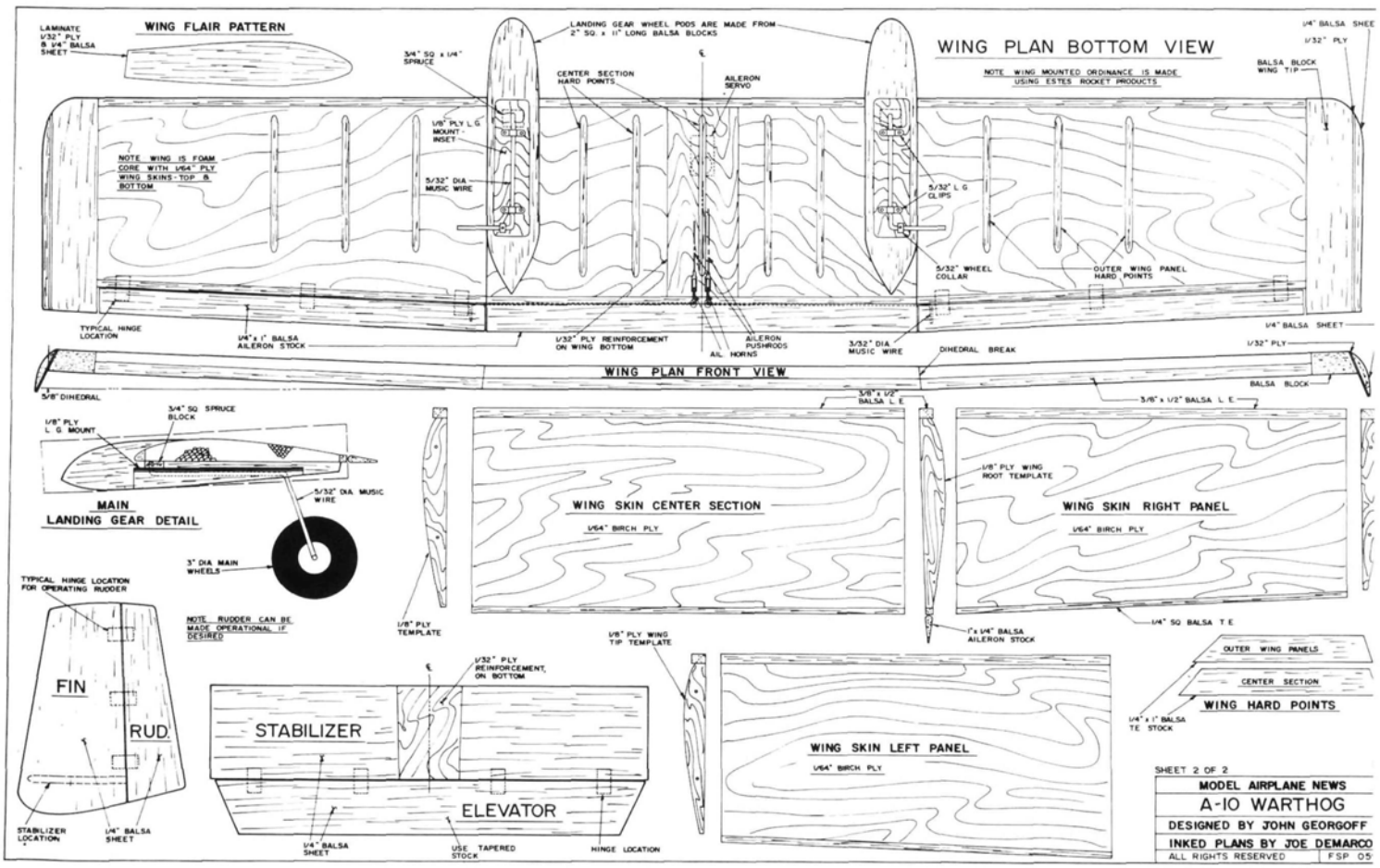
Install the engine-mount hold-down, which is made of ¼-inch plywood and goes between bulkheads 6 and 7. Sand its ends so that it meets the triangle stock on both sides of the fuselage and is flush with the top of the fuselage; then glue it into place using 15-minute epoxy. Reinforce the hold-down block with fiberglass tape and epoxy. Install the alignment wedge (see plans) and put the engine pod on the aircraft, and measure in ¾ inch from both sides of the fuselage on the front and back edges of the pod. Then drill and tap four holes to accept ¼-20x1 nylon screws.

ELEVATOR AND TAIL ASSEMBLY

On ¼x4x12-inch sheet balsa, trace the outlines of two of the vertical stab sections. Using ¼x2x15½-inch tapered stock, make two rudder sections. The horizontal-stab elevator is also made with ¼-inch sheet balsa. Make the horizontal stab out of ¼x3½x15¾-inch sheet balsa, and strengthen it with ⅓₂-inch plywood. Align the rear tail section with the tail-section cover; then turn the cover and tail face-down and drill



The tail feathers are made out of ¼-inch-thick sheet balsa. Rudders are optional and weren't used on the prototype.



the four holes through the stab. Add a piece of ¼x1½-inch trailing edge just in front of the stab, the width of the fuselage hatch cover.

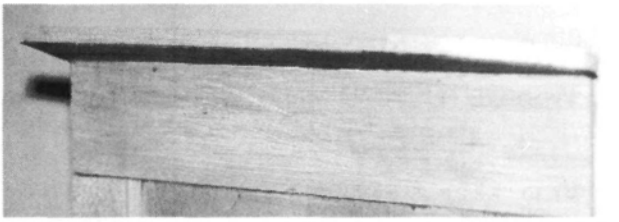
ENGINE POD

Make the horizontal engine-pod mounts with two pieces of ¼x3x15¼-inch basswood. Glue the pieces together lengthwise, and sand the leading and trailing edges to shape. Add the smaller triangular pieces to the rear of the mount, and install all the cowl hold-down blocks and engine-mount blocks with epoxy. Using epoxy, apply 1-inch fiberglass reinforcement tape to all the engine-mount blocks and the cowl hold-down blocks. Two K&B* 3.5 fan engines were mounted and the cowls installed. The cowls are made of 2-liter plastic soda bottles with the formed bottle bottom at each end. They're screwed into place (the screws are threaded into hardwood blocks).

THROTTLE LINKAGE

The throttle linkage for both engines is driven by one throttle servo. Make a Y-shaped flexible pushrod by soldering two lengths of 1/32-inch-diameter steel throttle cable to a single piece of 1/16-inch-diameter cable with a 1-inch long, 1/16-inch-i.d. brass tube acting as a coupler. Slide a piece of yellow inner pushrod over the cable, and slide the cable and pushrod into a length of red outer pushrod. Slide the two 1/32-inch-diameter steel throttle cables into lengths of Sullivan* 1/32-inch-diameter cable sheaths, and glue the ends of the sheaths into the ends of the outer pushrod.

Solder a clevis and a threaded coupler to the ends of the 1/32-inch throttle cables, and then attach the cables to the throttle arm, while clamping the ends of the throttle-cable sheaths to the engine-pod mount. Guide the 1/16-inch-diameter cable to the servo, and solder a clevis and a threaded coupler to the cable as well.



This view from the bottom of the wingtip shows the end plate used to produce the distinctive drooping tips used on the full-size aircraft.

PREP AND PAINT

After filling the dents and dings, prime the model and paint it. I used Du Pont Lucite acrylic lacquer paint for the base color and the airbrushed desert-sand-color camo shades. Also, I finished the entire area underneath the canopy, including the painting and all the details, and then I trimmed the canopy to fit.

I tacked the canopy down in five or six places with Super Jet*, then I glued all the canopy edges with J&Z Products'* RC-56 adhesive. I masked off the canopy and sprayed the entire model with flat, clear Hobbypoxy* for a scale, non-glossy finish.

WING ORDNANCE

Make the ordnance attachment pylon "hard points" out of 1x¼-inch trailing-edge stock in three lengths. Make the under-wing ordnance out of balsa, 1/64-inch-thick plywood and Estes model-rocket tubes. My A-10 carries two Sparrow and three Maverick missiles, two "droppable" fuel tanks and one AN/ALQ-119 electronic countermeasure pod.

Mount the ordnance to the pylons with 1-inch pieces of Gold-N-Push Rod*. Glue the smaller inner rod pieces to the bottom of the pylon mounts, and glue the corresponding outer pieces to the missiles. Cut an 1/8-inch-wide slot in the top of each outer piece; this allows them to be slid over the inner rod pieces below the mounts. To prevent the missiles from sliding off, thread a washer and a screw into the ends of each inner rod. With everything painted and installed under its wing, the model looks like a killer.

I really enjoyed designing and building my A-10 Warthog. The Gulf War made me a fan of the A-10, and now I own my own. You can, too! Happy building!

**Here are the addresses of the companies mentioned in this article:*

Wing Mfg. Co., *306 E. Simmons, Galesburg, IL 61401; (309) 342-3009.*

Dremel, *4915 21st St., Racine, WI 53406.*

K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.*

Sullivan Products, *P.O. Box 5166, Baltimore, MD 21224.*

Super Jet; *distributed by Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651.*

J&Z Products, *25029 S. Vermont Ave., Harbor City, CA 90710.*

Hobbypoxy Products; *a division of Petit Paint Co. Inc., 36 Pine St., Rockaway, NJ 07866.*

Gold-N-Push Rods; *distributed by Sullivan Products, P.O. Box 5166, Baltimore, MD 21224.*

Zinger; *distributed J&Z Products (address above).*

Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*

Carl Goldberg Models *(see address above).*

Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.*

Mac Products, *7935 Carlton Rd., Sacramento, CA 95826.* ■

MATERIALS and ACCESSORIES

Balsa sheet
- Two 1/8x4x42-inch sides
- Two 1/8x3x36-inch pieces for top and bottom
- ¼x2x36-inch wingtips
- ¼x4x36-inch tail elevator
- Two ¼x1x36-inch tapered-end aileron stock
- ¼x2x36-inch tapered-end elevator stock

Balsa sticks
- 1/8-inch-square tail-surface detail for elevator
- 1/8x3/16x36-inch wing detail
- Two 36x¼x¼-inch wing trailing edges
- Two 3/8x½x36-inch leading edges

Balsa triangles
- Six ½x½x36-inch

Block balsa
- 4x2¾x3½-inch nose cone
- 2½x2x1½-inch tail cone
- Two 2x2x12-inch wingtips
- Two 2x2x11-inch wheel pods

Plywood
- 1/64x16x16-inch wing sheeting
- 1/32x 9x10-inch wingtip couch tail
- 1/8x12x12-inch bulkheads
- 3/16x3x4-inch nose-gear bulkhead
- ¼x7x8-inch hatch-cover hold-downs

Hardwood
- Four ½x¼x6-inch cowl hold-downs
- Four 9/16x9/16x1¾-inch L-shaped engine mounts
- Two ¾x½x3½-inch wing hold-downs
- Two ¾x½x2-inch wing hold-downs

Basswood
- Two ¼x3x24-inch engine pods

Balsa trailing edges
- Three ¼x1x36-inch hard points
- Eight 8-32x1-inch nylon bolts for hatch cover (Sig* no. SH-173)
- Eight ¼-20x2-inch bolts for wing and motor pod (Sig no. SH-520)
- Eight 4-40x1½-inch socket-head screws for motor mount (Goldberg* no. 508)
- Eight 2x3/8-inch sheet-metal screws for cowl (Goldberg no. 563)
- Four 5/32-inch landing-gear clamps (Goldberg no. 287)
- Strip aileron horn set (Sig no. SH594)
- Three 5/32-inch Dura-collars (Du-Bro* no. 140)
- Eight 4-40 blind nuts (Du-Bro no. 135)
- 5/32-inch music wire
- 5/32-inch universal nose gear (Du-Bro no. 154)
- 1¼-inch nylon steering arm of 5/32-inch nose-gear wire (Du-Bro)
- 5/32-inch nose-gear mount (Du-Bro no. 156)
- 5/32-inch adjustable axle (Goldberg no. 300)
- Two 3-inch Skylite airplane wheels (Sullivan no. 877)
- 2½-inch Skylite airplane wheel (Sullivan no. 875)
- Control horn (Du-Bro no. 237)
- 18 hinges (Du-Bro no. 119)
- WW II canopy (Sig no. WC809)
- 12-ounce rectangular fuel tank (Sullivan no. 424)
- Two 3.5 ducted-fan engines (K&B no. 8910)
- Two Wizard tuned pipes (Mac Products* no. 1821)
- Set of foam wing-cores (homemade or by Wing Mfg. Co.)

Accessories
- Fiberglass reinforcement tape (Goldberg no. 452, 4 ounce)
- 5-minute epoxy (Hobbypoxy Formula 4)
- 45-minute epoxy (Hobbypoxy Formula2)
- R/C 56 Willhold glue
- 36-inch flex-cable set (Du-Bro)
- Two 2-liter soda bottles

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

Midwest

by JIM SIMPSON

THE NORTH AMERICAN AT-6 is probably the most well-known military trainer ever made. In factories in the U.S. and around the world, more than 20,000 AT-6s were manufactured to be used as workhorses to turn new cadets into front-line fighter pilots. The AT-6 was perfect for this role as well as many others.

With its powerful 600hp Pratt & Whitney "Wasp" radial engine, the AT-6 prepared pilots for their first solo flights in P-51 Mustangs. Neither the easiest airplane to fly, nor the most forgiving, it equipped pilots for combat. It was a popular instrument trainer; many gunners first fired a machine gun from the back seat of an AT-6.

After the war, many AT-6s and Navy SNJs were sold on the civilian market. The sight and sound of an AT-6 bellowing smoke while performing low-level aerobatics is something you won't soon forget. The plane is in its own class at the annual Reno Unlimited Air race, and it's a very popular event.

THE KIT

Although only a few weeks had elapsed, it seemed as if a year had passed between the time I received the assignment to review the Midwest AT-6 Texan and the day UPS finally brought the kit to my door.*

AT-6 Texan

With its powerful 600hp Pratt & Whitney "Wasp" radial engine, the AT-6 prepared pilots for their first solo flights in P-51 Mustangs.

1.20-size warbird classic

COLOR PHOTOS BY DAN PARSONS

SPECIFICATIONS

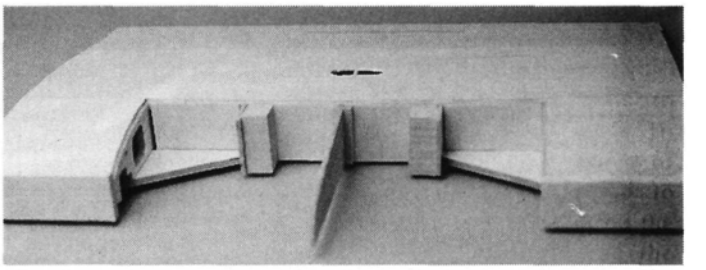
Model name: AT-6 Texan
Type: ⅛-scale sport military trainer
Manufacturer: Midwest Products Co.
List price: $349
Wingspan: 83 in.
Wing area: 1,000 sq. in.
Weight: 10 to 15 lb. (14.5 lb. with full fuel tank)
Wing loading: 32 oz. per sq. ft.
Airfoil type: semisymmetrical
Washout built-in?: yes
Length: 55 in.
Sug. engine range: .90 to 1.20 2-stroke; 1.20 to 1.60 4-stroke
Engine used: O.S. 4-stroke 1.20 Surpass II with pump
Prop used: 16x6
No. of channels req'd: 5 (ailerons, elevator, throttle, rudder and retracts)
Wing construction: wood
Fuselage construction: wood

Features: the fuselage is a self-jigging Micro-Lite plywood framework that's built flat on the workbench and covered with sheet balsa (patterns on plans). The clear plastic canopy has a molded-in framework, and the cowl is of heavy-duty ABS plastic. To ensure accurate alignment, the all-wood wing has jig tabs on each rib. Laser-cut birch plywood gear support ribs and spruce spars maximize strength. A molded ABS wheel well and optional Robart retracts are perfect companions. Tail surfaces are balsa sheet over framework, and all movable surfaces are balsa-sheet cores with balsa ribs to create a scale appearance. For maximum flexibility, stock fixed landing-gear units are interchangeable with the optional Robart retracts. The generous hardware package even includes a couple of spare wing hold-down bolts! Three sheets of large computer-drawn plans and a 58-page construction manual make building easier. Colorful decals are also provided to enhance the scale effect.

HITS
- Exceptional, high-quality wood
- Laser-cut (aircraft-quality) birch plywood
- Custom-designed to accept Robart retracts
- Strong, heavy-duty ABS cowl and wheel wells
- Accurate, one-piece canopy with molded frame
- Fully detailed, illustrated construction manual
- Excellent flight performance
- Three large sheets of plans, including all patterns
- Interchangeable fixed or retractable (optional) landing gear
- Complete hardware package

MISSES
- No operating flaps
- No instrument panel on decal sheet (Future kits will include an instrument panel.)

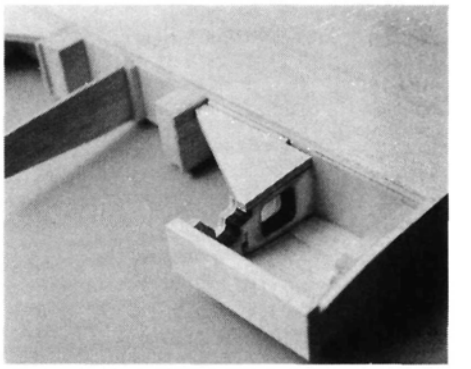
Was it worth the wait? Oh, heck yes! Box art doesn't usually impress me, but this kit's did. The box is big. Big picture. Hmmm—gonna be a big project. Good. It seems as if bigger is also easier and oh, so beautiful. What is it about big, yellow airplanes?—something magical, for sure.



The wing center section is built flat without dihedral. Here you can see the strong landing-gear-mount section. The formed ABS wheel-well cover hasn't yet been installed.

I felt compelled to follow the manufacturer's instructions closely, so I actually read through the construction manual the night before I started to work on the plane. In this 58-page book, great line drawings are used to illustrate more than 260 steps. This kit really isn't for beginners, though.

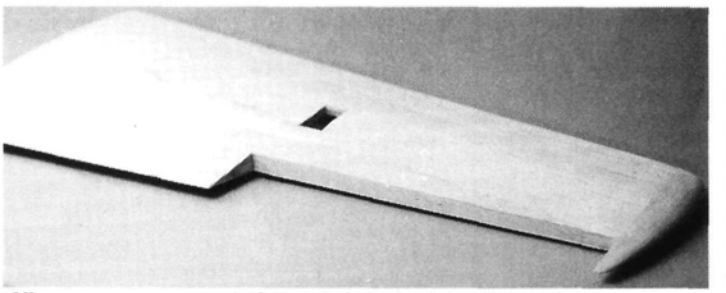
Next, I cut the plans apart and began to put the various components together. I also started to round up additional items needed to finish the project. The manual contains a list of these items, including the choice of fixed landing gear and Robart* retracts. Let's discuss choices first.



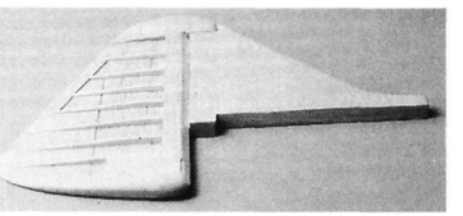
Here you see the ¼-inch-thick plywood ribs and the ¼-inch-thick plywood plate that make up the retractable landing-gear mount in the wing center section.

FIXED OR RETRACT GEAR

Cost might prevent some from installing retractable landing gear, but in my opinion, the retracts are worth every penny! (See the sidebar, "Down and Locked.") This kit is unique in that you can build the model with fixed gear, and when you're ready to upgrade, you can remove the fixed-gear module and install retracts. Just screw them into place on the plywood plate that's built into the custom-designed wing center section. No modifications are required.



Aileron servos are mounted directly in front of the ailerons for a simple, direct-control linkage run. I glued the wing sheeting together and then sanded it before I glued the one-piece skin to the wing.



The fin and the rudder are typical of the construction of all the control surfaces in the kit. The fin is fully sheeted, and the rudder has a solid sheet core with ribs glued to each side.

ENGINE CONSIDERATIONS

Engine choice is also important. The list recommends an O.S.* 1.08 and a 15x6 prop. I chose a 4-stroke O.S. 1.20 Surpass II with a pump and a 16x6 prop. (The altitude at my favorite gas" field is 5,290 feet.) My engine turns 8,500rpm and flies my 14½-pound AT-6 well (with a full tank). Since there's no such thing as a free lunch, there must be a catch. There is. The short nose requires a lighter tail. A good friend machined a steel spinner for me. It weighs 18 ounces and balances the plane right on the center of the main wing spar, and this enables the plane to fly straight and level with zero trim deflection. The point is this: a lighter engine requires more nose weight than a heavier one.

CONSTRUCTION NOTES

All the movable surfaces have sheet-balsa cores with balsa strips glued on both sides to simulate fabric-covered ribs. After you've built these, sand the elevators and the ailerons in pairs so that they're the same size. There was one thing about the

(Continued on page 32)

FLIGHT PERFORMANCE

Well, this is what it's all about, isn't it? Given the holidays, It took me a lot longer than usual to build this plane; the kit was delivered just before Thanksgiving, and I didn't test-fly until the Wednesday before New Year's Day, so I had a lot of time to worry about the test flight.

• Takeoff

When my friend Dan Parsons had finished taking pictures of the AT-6, I fueled it and started the engine. Because it was a cold day, I left the glow-plug battery on as I taxied out to the end of the runway. Dan stayed near midfield, so after I had turned into the wind and stopped, I disconnected the McDaniel* Ni-starter, bumped up the throttle and began the takeoff roll. Wow! As it came up to speed, the tail lifted, and I checked the rudder: right, left, right, and what do you know? It was airborne. Did I give it a touch of up, or did it just lift off? Remembering that air speed is our best friend at low altitude, I continued a slow, gentle climb and started a wide left turn about 50 feet above the ground. I made another left turn at my end of the runway, and once the plane was level, I hit the retract switch. Click. Gear up. Takeoff complete. Piece of cake!

• Landing

Because much of this first flight consisted of racetrack patterns over the long runway, my landing approach would simply be a low-altitude upwind leg. I carried a little power even after crossing the approach end of the runway, so I was "high and hot," meaning a touch-and-go was in order. I chopped power to idle and dropped the plane onto the pavement. The oleo struts worked well, and I applied power and "went around." The next approach was a long, low "drag it on" affair. This time, I slowly decreased the power coming down the chute, so there were just a couple of clicks of throttle left as I crossed the end of the runway. I pulled the stick to idle, and the AT-6 floated onto the runway and rolled out nicely. This plane is a lot of fun and very impressive!

• High-speed performance

In this case, I must say that high speed is relative. Full-scale AT-6s make a lot of noise but are no faster than DC-3s. According to Andy Lennon's article, "Estimating Level Flight Speeds" (*Model Airplane News,* February '94), this AT-6 is smokin' along at 60mph! It sounds faster. I *know* my Sr. Falcon goes 58mph with the throttle stick only three clicks above idle. I sure think that the AT-6 is faster than 60. Whatever. It's rock stable with the gear up and the throttle on high.

• Low-speed performance

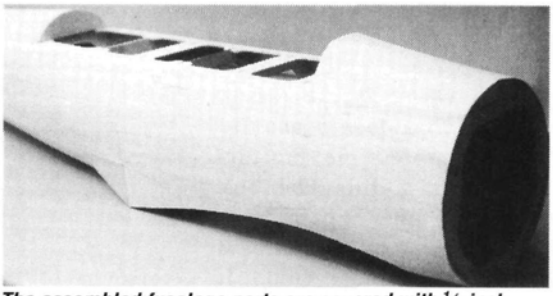
While I was flying low-altitude camera passes for Dan, he hollered, "Slow it down some." I asked him to let me mess with it for a minute and took it up about two mistakes high to experiment with slow flight. It does this very well, but I didn't aggravate it into a snap or a stall. Then I brought it back down for more passes, and I flew left-banking turns while holding top (right) rudder. The turns were slow and stable, with no tendency to snap-roll or stall out here, either.

• Aerobatics

Because most maneuvers are combinations of rolls and loops, I'll limit my discussion to these. The first loop was with full up-elevator from level flight. The AT-6 went up through the first half of the loop and then rolled out on top. In the next loop, I used less up-elevator from level flight, and the plane lost about 15 degrees of heading going over the top. Hmmm. Still too much up. OK. The third loop was flown faster with less up-elevator and was perfectly round with no heading change. Great. All I had to do was reduce elevator throw ⅛ inch.

Rolls are very pretty. A touch of down-elevator is required while the plane is upside down, but there's plenty of time to put it in.

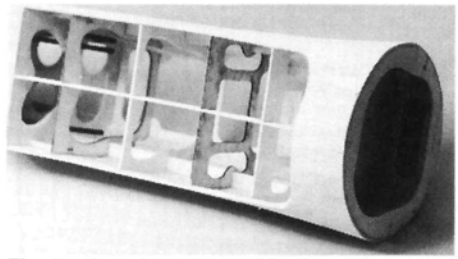
My overall impression is that this is a good, honest airplane that demonstrates better flying attributes than most scale airplanes. It's very stable for AT-6 racing. Best of all, it's a lot of fun for everyday flying. But, oh, how great it would be if it just had flaps!



The assembled fuselage parts are covered with ⅛-inch-thick balsa sheeting, and the finished structure is lightweight and strong. Notice the plywood panel just aft of the wing saddle; it's wrapped around the lower fuselage and blends the square portion of the fuse into the rounded aft section.

wing construction that I couldn't bring myself to do. The manual tells you to add the wing sheeting one piece at a time. I really didn't want any seams or glue to show, so I edge-glued all the planks together and sanded the outside surfaces with a hand-held power sander before I added the sheeting to the wing.

For this project, I used Satellite City* Ultra Gap Filling Hot Stuff. To skin the wing, I ran a bead of this glue along the skin's front edge and set the skin in place as shown in step 56. You have about a minute to do this when you use Hot Stuff. Spray the top only with Hot Shot* accelerator. Then run a bead along the spar, along the top of the trailing edge and on top of each rib about halfway between the spar and the trailing edge. Now, quickly push the skin down, and hold it in place with stacks of magazines until it has set. Later, when you turn the wing panel over, finish gluing the skin to the ribs. By the time you're ready to skin the bottom wings, you'll be proficient enough to glue all the skin at once. This method provides the smoothest

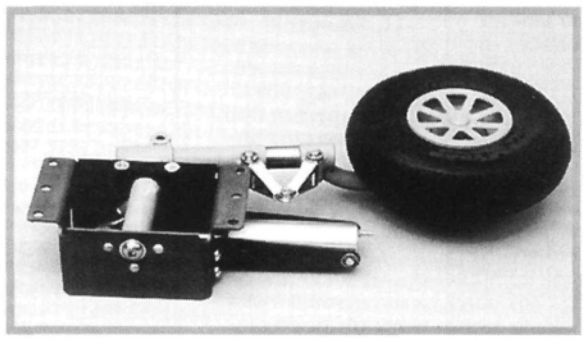


The fuselage has plywood keels and laser-cut plywood formers that fit very well.

DOWN AND LOCKED

The Robart pneumatic retracts (no. 620) and the Midwest Texan kit were made for each other. Each was designed with the other in mind, and installation is a snap with the two included sets of illustrated instructions. Best of all, the system works like a charm. I pressurized the system to 100psi, and four days later, after I had cycled the gear 15 times, it still had 40psi. That's amazing!

Like their bigger brothers, these retracts are screwed onto plywood plates that are built into the wing structure. More than just a miniature version of the Robart ⅛-scale AT-6 retracts, these units were designed by Robart to be both functional and very scale-like. The gear feature ¼-inch-diameter, heat-treated steel axles; positive up and down locks; and fully operational oleo damping shock struts. An aluminum main frame supports a strong, glass-filled bearing block, and a strong steel trunnion pivots within the frame. The units are driven by a Robart Precision Air cylinder, and the struts themselves are made of aircraft-grade steel tube. These struts are also adjustable for setting any toe-in needed for proper tracking of the model. Another plus is that Robart has replacement parts for all their retracts; this is nice to know in case something goes amiss and your retracts get damaged.



Installation of the air-control system was easy; Robart's no. 188 Air Control kit contains all the parts needed to hook up this system in the AT-6, including an air-control valve, an air-fill valve, a supply of air line (in two colors), an air tank and air fittings. A standard servo is all that's required to operate the valve, and installing the servo and the valve was very easy. Some additional items were required to complete the air system. I used an additional air tank (no. 172); tied together, the two tanks have enough air capacity for a dozen cycles of the retracts. Because the wing is removable and the air tanks are mounted in the fuselage, I included Robart no. 190 Air Line disconnects, which make removing the wing a snap. Simply push the disconnects together, and with a slight twist, you can lock them together for a positive seal. It's as simple as plugging in a servo lead!

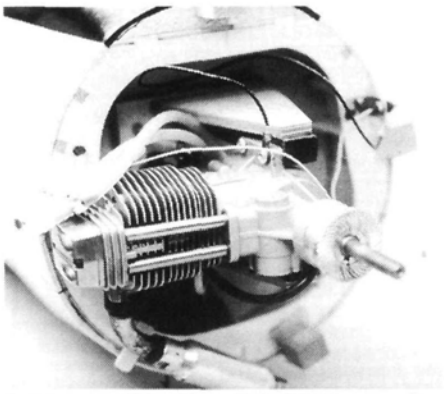
Two more great items are Robart's Air Line Restricters (no. 189) and their new Onboard Air Pressure gauge (no. 173). The line restricters are made of brass, and when they're installed over the air lines, they slow the retract time for nice scale-like operation. The air gauge, which is installed with a T-fitting has a calibrated shaft that indicates actual air pressure in the tank. The more pressure there is in the system, the more lines on the shaft are visible. The fitting is threaded and can easily be mounted on the fuselage, so the gauge is easy to see at the flying field. A quick look is all it takes to know exactly how much air you have left in the tank. The entire air-control system—the retracts, the air-control kit, the additional air tank, the restricters, the disconnects, the onboard air gauge and the air pump—costs $275. What a deal!

wing surfaces I've ever seen—no glue marks, no lines and no uneven seams.

I have a suggestion that will save some frustration in the wing-center-section construction. Step 210 suggests that you round the inside edges of the cutouts in the ¼-inch plywood ribs to make it easier to slide the retract unit into place. Do this while you do step 91. Also, before you glue the ¼-inch plywood inboard landing-gear plates into place, cut the triangular notches to clear the oleo scissors on the landing-gear struts. It's much easier to cut the ¼-inch plywood with a Dremel* Moto-Tool or a band saw than by hand after the parts have been glued in place.

FUSELAGE

The all-plywood (mostly lite-ply) fuselage frame weighs only 1 pound, 2 ounces. All aircraft-grade (birch) plywood parts in this kit are laser cut (the edges are slightly charred) and fit perfectly. The formers are



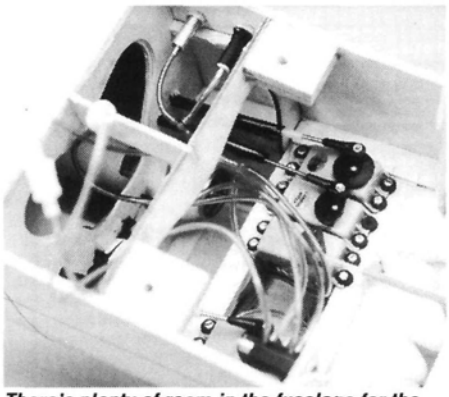
I power my AT-6 with an O.S. 1.20 Surpass II 4-stroke engine with a pump. I made an engine mount out of scrap plywood left over from the kit. The firewall is recessed.

assembled around a vertical keel, and after they have been glued together, the fuselage is planked with ⅛-inch-thick balsa sheet. A single piece of 1/64-inch plywood is used to make the transition from the square fuselage formers to the round aft formers on the fuselage bottom, just aft of the wing trailing edge. It does the job beautifully.

There's a discrepancy in the drawing for step 194. To properly follow the fuselage contour, you should be aware that the tail fairing blocks must be tapered to a point at the aft end.

FINISHING TOUCHES

Finishing this plane was relatively easy. First, cover all the wooden parts with Cub Yellow MonoKote*. Then paint the large plastic parts with color-matching LusterKote paint, masking when necessary. I didn't have the patience to cut 1/32-inch-



There's plenty of room in the fuselage for the radio gear and all the retract support equipment. Notice the fill valve and the pressure-gauge fittings at the upper left corner.

wide MonoKote strips, so I bought a 1x3-foot vinyl sheet of 100 laser-cut strips at a local art-supply store to detail my model. My friend Pat Tritle did the canopy for me. He's a great modeler and does an exceptional job with plastics. He covered the windows with masking tape and then sprayed the outside frame with a zinc chromate green, then white and, finally, Cub Yellow. This gives the proper yellow color on the outside surfaces, and the green is visible on the inside. The white prevents the green from showing through the yellow.

The manual refers to an instrument-panel decal, but my kit didn't have one, so I installed an old plastic Formula One race-pilot bust in the cockpit and glued the canopy on without a panel. Well, why not a race pilot? AT-6 racing is a big deal, so it's appropriate.

The manual also specifies the amount of each control-surface movement, measured at the trailing edge, both up and down. It also illustrates how to balance the model. If you balance it right on the center of the main wing spar and use the specified control throws, your model will fly well. If you fail to do so, you'll deserve what you get. Aft balance points and too much up-elevator throw will guarantee a snap-roll!

The Midwest AT-6 Texan is a well-engineered kit and, with the Robart retracts made especially for the kit, the combination is very satisfying. Whether you want a WW II military trainer or a hot Reno racer, you should give this Texan a try.

**Here are the addresses of the companies mentioned in this article:*
Midwest Products Inc., *400 S. Indiana St., P.O. Box 564, Hobart, IN 46342.*
Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*
O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Satellite City, *P.O. Box 836, Simi, CA 93062.*
Hot Shot; *distributed by Satellite City (address above).*
Dremel, *4915 21st St., Racine, WI 53406.*
MonoKote/Great Planes Model Distributors *(address above).*
McDaniel R/C Inc., *1654 Crofton Blvd., Ste. 4, Crofton, MD 21114.* ■

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1994. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

WHIPPING UP A WIZARD

Rich Hutchings of Rochester, NY, sent us this picture of his first scratch-built project—an electric-powered EZ Wizard from Dave Baron *Model Airplane News* plans (no. FSP05911). The model is outfitted with the "guts" of an Electric Hots kit, including a Futaba 4-channel radio, a 05 electric motor, a 7x6 Grish prop and a 1400mAh battery. The EZ Wizard is covered and trimmed with MonoKote and weighs 38 ounces. Rich's daughter Sammie displays the model for us.

DORNIER DO-X

This flying boat that's powered by 12 engines is the madcap project of Jon Christenson of Minneapolis, MN. The 1929 Dornier, DO-X transcontinental transport has a 96-inch wingspan and a solid foam fuselage. Jon uses extensively modified Cox Queen Bee engines fit with .09 pistons and cylinders, bronze bushings and modified carburetors. One throttle servo operates all 12 engines, and Jon says that the sound is indescribably awesome!

BACKYARD BARGAIN

Ken Hanson of Pelham, NH, built this 1/2A Stealth Sport from *Model Airplane News* plans. Most of the wood used in its construction came from Ken's scrap box, and the plane, sans canopy, weighs only 18 ounces. MonoKote was used for the finish. He powers it with a Cox Black Widow .049 engine. "The plane flies great! And the rolls are a blur," reports Ken, who highly recommends the design for the budget-minded modeler.

SWEDISH SKYRAIDER

Eric Persson of Arvika, Sweden, sent this photo of his semi-scale, all-yellow Douglas Skyraider, air-target tow-plane. The full-size aircraft was used in his country's Air Force for air-defense practice. The 61-inch-span model is powered by an Enya .60 long-stroke engine with a homemade muffler that places the exhaust at the scale locations. Construction is conventional balsa and ply from Eric's own drawings. The fiberglass cowl, spinner and the scale, four-blade prop are homemade.

PHOTOS BY TOM ATWOOD

GRAUPNER

Biene Electric Sailplane

An ARF with truly superior thermalling performance

• by TOM ATWOOD •

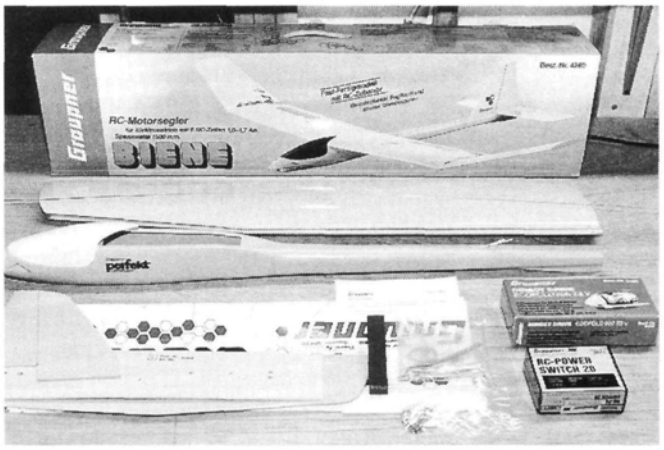
THE GRAUPNER BIENE is a thermalling electric glider that's distributed in the U.S. by Hobby Lobby Intl. This plane gets particularly high marks because of its superb endurance capability. I have built and flown an electrified Dynaflite Piece O' Cake, two Carl Goldberg Electras and three Graupner Uhus, so I have a fairly good basis of comparison when evaluating the Biene.*

It wasn't until I had assembled and flown the Biene (pronounced "been-uh," which means "bee" in German), that I finally found the convergence of two important qualities—quick assembly and dramatic gains in flight times over the electric models I had previously flown.

The Biene offers light weight, simple assembly, e.g., the wings and tail feathers come assembled, sheeted and covered with bright yellow Oracover*, and, most important, astounding duration. It's of a similar size to the Uhu, but it's lighter and does not fly as fast. One of our first test flights (flown by *Model Airplane News* test pilot David Baron—see sidebar) lasted 21.5 minutes. This flight was flown in the fall in the Northeast, around 6 p.m., in overcast conditions, i.e., in predominantly down air. That flight included some duration-robbing aerobatics (a loop and a slow roll), yet the plane still stayed aloft for slightly over a third of an hour.

When powered by the "low amp" Graupner* Speed 600 Eco 7.2 recommended by Hobby Lobby, the plane still has enough power and agility to be flown in a relatively tight circle just feet above the ground—if you have a good pair of thumbs. It's an ideal airplane for a beginner or an intermediate modeler who wants a smaller plane with serious thermalling talent. The plane can be quickly disassembled and packed in its kit box, which has a suitcase-style carrying handle.

The Hobby Lobby catalogue says you can build this plane in three hours. I built two (I gave them to beginners), and each took me at least three times that long to complete. If, like me, you don't like to rush, give yourself two or three evenings to complete the kit. Construction is simple and straightforward.



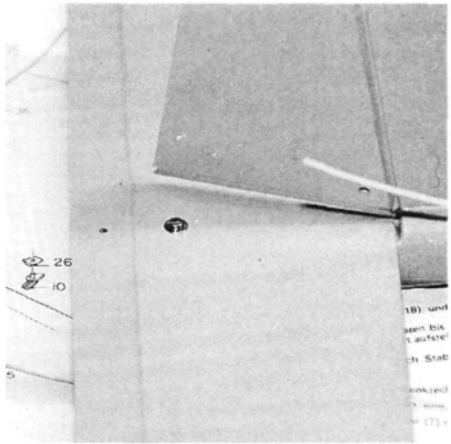
The kit contents and separately available Speed 600 Eco motor and Power Switch 20 are shown.

ASSEMBLY

The formed-plastic fuselage requires some minor carving to open up the air inlets. You must fit a few wooden die-cut parts into the front of the fuselage. The resulting structure neatly holds the elevator and rudder servos, radio receiver, battery, on/off switch and other components of the power system. A round piece of die-cut plywood is glued to the inner face of the molded firewall, and the motor is simply bolted in. You'll need to use Stabilit Express* to glue the wooden parts to the plastic fuse.

Although the kit contains standard Bowden cables—the Graupner equivalent of Gold-N-Pushrods*—and special wire inserts that a supplementary instruction sheet indicates should be slid into the length of the inner Bowden cables as reinforcement, I opted to use standard nylon Gold-N-Pushrods. On one of my Uhus, I experienced flex-induced failure of the outer sleeve of the Bowden cables, and rather than modify the cables as suggested, I found it easier to substitute the others. To glue the outer sleeve of the Gold-N-Pushrods to the fuse, I wrapped the contact points on the sleeve with masking tape, abraded the tape's outer surface and stuck it to the fuse with Stabilit Express.

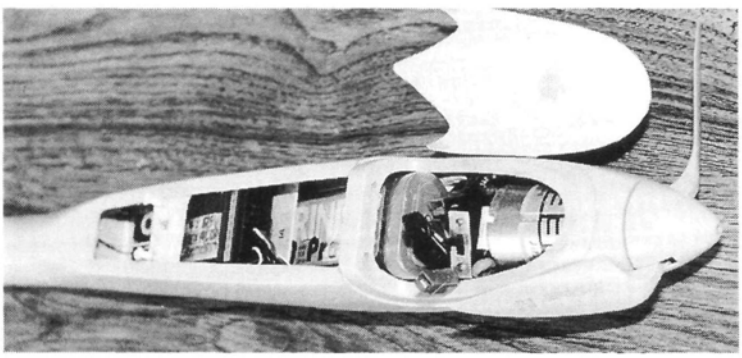
The Graupner Power Switch 20 is recommended for this airplane. It has a battery eliminator circuit and thus powers the entire flight system from the motor pack, turns the motor on and off, cuts the motor off at the end of a run (to preserve battery power for the receiver and servos) and has a propeller brake. One piece of advice: there is *exactly* enough room under the glued-in battery tray for this on/off switch. You'll want to slide the on/off switch and battery into place to make sure everything fits properly before you glue in the battery tray. Then bolt in the motor.



The stabilizer and elevator are removable, so the kit can always be easily packed in the kit box.

To save space and minimize resistance, I soldered the motor leads directly to the leads from the Power Switch 20. I used Sermos* snap connectors to connect the battery and the other set of Power Switch 20 leads.

The canopy is intended to be held down



The flight system components are tightly packed into the Biene's fuselage. Two servos are mounted at the rear.

FLIGHT PERFORMANCE
by David C. Baron

• Test flight
I certainly underestimated the efficiency of this motor/battery/propeller combination. I did accept a lackluster climb to altitude, but was very impressed by the performance I got. The Biene does not offer the climb speed of the Uhu, yet its higher-lift wing gives ample climb performance at the reduced air speed. It took just a little bit of fiddling with the elevator trim to arrive at an excellent hands-off rate of climb. Once at altitude, the Biene exhibited exceptional thermalling performance. Since it is a rudder- and elevator-controlled design, it can perform a much tighter, flatter thermalling turn than aileron-controlled designs of similar size.

I descended for landing with enough power left for many go-arounds. My first couple of approaches overshot the runway. I would hate to spoil the plane's light design by adding some kind of spoiler device. If you have a speed controller that can give you good low-speed idle performance, it can offer you a reasonable speed break if it's set at a throttle position that barely rotates the propeller.

• Launching and landing
The aircraft is very easy to hold, and its excellent low-speed performance makes it a cinch to launch. Just be sure to launch it flat and straight. Be very subtle with your elevator commands right after launch so that you don't accidentally stall before you reach flight speed. Landings are a piece of cake as long as you plan a long flat approach and expect to use a lot of the runway. It would take a skilled hand to consistently do spot landings with this aircraft.

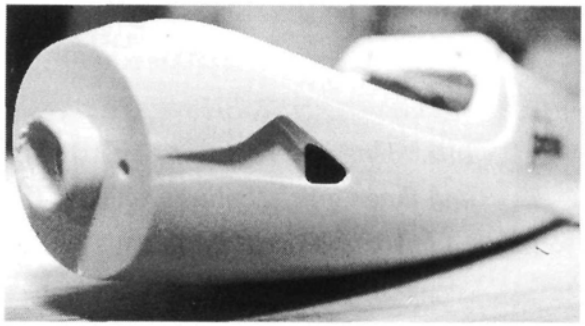
• Low-speed performance
Despite its slow flight speed, the Biene exhibits a very flat glide. The aircraft handles predictably throughout the low-speed stall. It never exhibited any tendency to snap to the left or right.

• High-speed performance
The aircraft has such a low wing loading that any attempt to stall it at high speed only resulted in a very tight loop. When dashing from one thermal to another, or for getting out of an area of sink as quickly as possible, a healthy dose of down-trim was required to keep the aircraft moving at a high rate of speed.

• Aerobatics
Although slightly limited by its lack of ailerons, the Biene exhibited a respectable roll. Loops are so easy as to be passé, and I imagine that you could easily perform climbing loops in moderate lift.

• Conclusion
Whereas Graupner's first entry-level plane—the Uhu—flies at a good clip, the Biene is more of a slow-paced thermal design. The Uhu flies fast, and most of its attributes are those of a comfortable trainer. The Biene is everything you would want a training glider to be. It has an excellent low-end speed range coupled with excellent flight-control sensitivity. The motor/power system used in this design offers a substantial jump in duration compared with previous ARF designs.

by a rubber band that's attached to eyelets that you glue to the fuse floor and the underside of the canopy. Because the Power Switch 20 and various wiring blocked the area designated for the rubber band, I simply used clear packing tape to hinge one side of the canopy and to lock down the other before a flight.



There is very little work to be done on the fuselage. The air intakes must be carefully bored out.

WINGS AND TAIL GROUP
The wings come completely sheeted. You'll need to cut a slit along the polyhedral breaks, tuck the exposed edges of covering into the exposed slit, seal them with a covering iron, and then glue the joint together. Because the film covering on the wings does not wrap around the trailing edge, you may have to reseal some spots along the trailing edge, as I have, after a few trips to the flying field.

To assemble the wings, you must glue in metal sleeves for the metal wing joiner and mount blind nuts in the wing hold-down piece for the supplied nylon hold-down screws. The stab/elevator and fin/rudder are already hinged and covered. You glue in a small dowel at the front of the stab. This locks into a hole in the fuse, and a screw holds the rear of the stab down. The stab/elevator can be removed with the help of a screwdriver, thus allowing the completed plane to fit back into the original kit box. This is certainly one way to eliminate storage concerns and hangar rash. Finally, you apply a set of self-sticking decals to the wings and tail group, and you've finished. Both of the kits that I built came out with the CG right on the money.

With the servos installed, I positioned the Cox receiver to see how it would fit, which it did, but with no room to spare. A micro receiver and microservos are best in this kit.

RADIO
You'll need to use microservos such as the Futaba* S133 or an equivalent. The photos show a Cox* Cobra 3-channel radio. The radio worked perfectly, but the servos that come with it are a shade larger than microservos. To make them fit, build a small step on the servo-tray mount to elevate the mount by about 3/16 inch. The fit is tight, but there is enough room. On a second plane, I used standard microservos without a hitch.

CONCLUSION
This plane seems to embody all the lessons Graupner may have learned from the Uhu

(Continued on page 99)

SPECIFICATIONS

Model name: Biene (bee)
Manufacturer: Graupner (distributed by Hobby Lobby)
Type: electric thermal soarer
Wingspan: 63 in.
Wing area: 372 sq. in.
Airfoil: slightly undercambered
Weight: 40 oz., ready to fly
Wing loading: 15.5 oz./sq.ft.
Length: 32 in.
No. of channels req'd: 3 (on/off, rudder, elevator)
Rec'd. motor: Graupner Speed 600 Eco 7.2

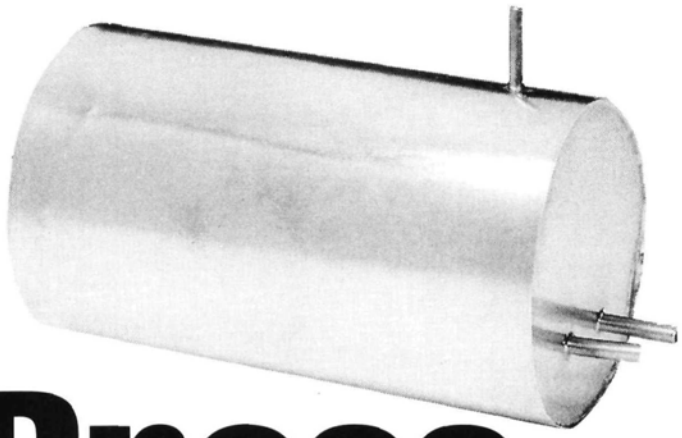
List price: $189 (without motor and Power Switch 20; with these items, add $95.50)

Features: the fuselage is formed plastic; the built-up wings come sheeted and covered with yellow Oracover. The stab/elevator and fin/rudder components are fully sheeted, hinged and covered. A complete hardware package comes in the kit. Motor, prop, on/off switch and battery must be bought separately.

Hits
- Truly exceptional duration/thermalling performance.
- Quick to build.
- High-quality die-cut bulkheads; excellent engineering throughout.

Misses
- Bowden cables require modification (see main article; I used Gold-N-Pushrods instead).
- Wing covering does not wrap around wing trailing edge.

HOW TO



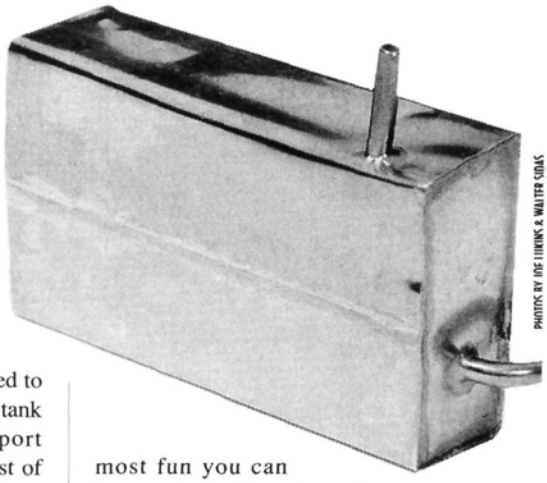
Top Brass

by JOE LUKINS

Make beautiful, functional, brass fuel tanks

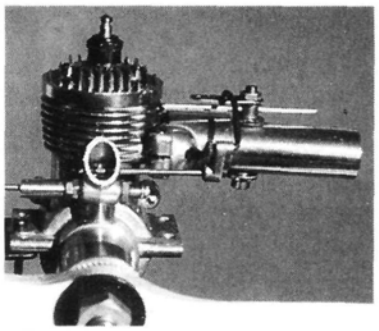
HOW many times have you said, "Dang, I wish they made fuel tanks that would fit my models?" Are you tired of trying to bend metal pipes into pretzel shapes and then watching as the tube kinks and fails? And if $2 sounds reasonable for a custom fuel tank, round up some brass sheet stock and some soldering stuff, and get set to enter the rewarding world of "top brass." Good planning and design permit these beautiful tanks to fit into any nook and cranny while always allowing space for foam cushioning. You determine the pipe and tubing locations. Brass fuel tanks are surprisingly durable and strong. The seam along the side of the tank adds longitudinal strength, while the end pieces are made of thicker material to add stability. Another valuable consideration, especially for small sizes, is that they weigh a lot less than their plastic brothers!

Many fun fliers out there are sick of seeing that old tank go sliding around on greasy rubber bands. Mount one of these brass jewels on the front of your flying machine, and you will have upgraded to the best looking of the lot. The tank on my fun flier is shaped to fit around the nylon landing gear. The tank in my high-performance Stealth Sport (House of Balsa* kit) may be the neatest of all. Weighing just ½ ounce and holding 2 ounces of fuel, it fits perfectly, allows efficient tubing runs and offers a pristine equipment layout. This is the best way to accommodate the new carbureted Cox* Tee Dee R/C .09 engine and three servos in this little hot rod.



PHOTOS BY WALTER S. SUKMIT, JOE AT SCALE

Working with brass can be a relaxing addition to your modeling skills. You get to figure and fiddle, and solder and polish this fine metal; for sure, this is the most fun you can have while holding a hot soldering iron. Fabrication and soldering techniques are presented in this article so that a beginner will soon get great results. For practice, start by making a 1½x2½x3-inch-long rectangular tank. This handy size (6-ounce, see chart) uses one .005-inch-thick brass sheet and a bit of .010-inch-thick sheet. The first attempts may not produce a flawless product, but don't be discouraged. Practice really does make for rapid improvement. Care, patience and precision are all keystones of good sheet-metal working.



I had to make a brass tank for my .10 Cameron; others would not do!

When you've installed your first brass tank, you may be tempted to taxi around with the hatch cover removed and the new tank glistening. If the guys at the field start razzing, tell them, "*Model Airplane News* makes me do it!"

As you can see, the tools and materials needed to make beautiful brass fuel tanks are few and inexpensive.

Tools

- soldering iron, chisel point (30 watts)
- pliers
- scissors
- scribe (a dart is a handy shop tool)
- metal ruler
- fine-tooth metal file
- alcohol and a clean rag

Materials

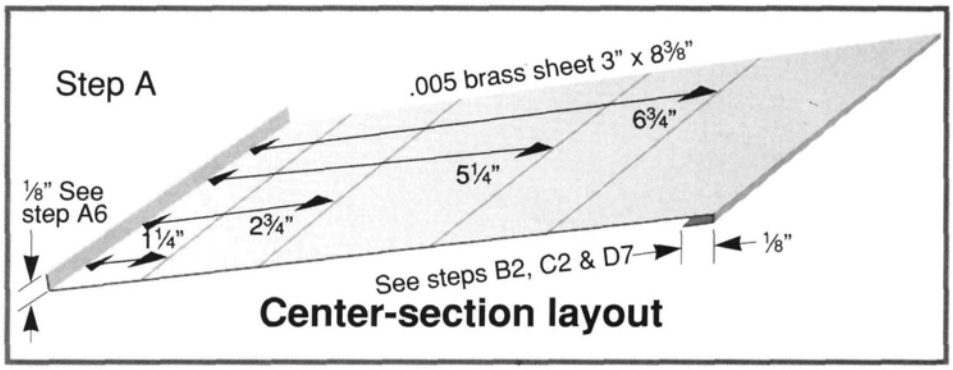
- soldering paste
- 60/40 rosin-core solder
- 4x10-inch, .005-inch-thick brass sheet (K&S no. 250)
- 4x10-inch, .010-inch-thick brass sheet (K&S no. 251)
- brass or copper pipe (K&S no. 121 or no. 127)
- fuel tubing and clunk

STEP A—TANK CENTER-SECTION PLANNING AND LAYOUT—.005 BRASS

The following steps are used to make a 1½x2½x3-inch rectangular tank with a 6-ounce fuel capacity:

1. Determine the width (1½ inches) and height (2½ inches) of the tank to fit your model. Always allow for a little foam cushioning.
2. Use the Tank Sizing Chart to determine the length of the tank (3 inches, see sample on chart) for the desired (6-ounce) fuel volume.
3. Calculate the overall length of stock required to make the main body, which is the perimeter of the tank, plus a ⅜-inch allowance for making the overlap joint, i.e., the interlocking seam. (Two overlaps at ⅛ inch each, plus ⅛ inch lost in joining.)

For this tank, the perimeter equals 8 inches; therefore, the overall material length is 8⅜ inches.



Center-section layout

4. Wipe both sides of two 4x10-inch brass sheets with alcohol.
5. Mark the .005 sheet at 3x8⅜ inches, and cut with scissors.
6. At the 3-inch end, scribe across at ⅛ inch. Use pliers with light pressure, and bend the sheet up 90 degrees at the ⅛-inch mark.
7. Using the inside of this fold as the left stop for your ruler, measure, mark and scribe across the brass material:

—at 1¼ inch (half of the 2½-inch side; this locates the seam near the center)
—at 2¾ inches (1½ inches added for short side)
—at 5¼ inches (2½ inches added for long side)
—at 6¾ inches (1½ inches added for short side)

Now, turn the brass over; mark, scribe and bend a ⅛-inch fold in the opposite direction from the left ⅛-inch fold.

General soldering tips for making brass assemblies

Start by wiping both sides of the brass sheets with alcohol. Lightly sand the brass pipes. Any traces of oil must be removed. Use a 30W soldering iron with a chisel point. Always tin the iron's point (coat with solder), and keep it clean with frequent wiping. Lightly brush the parts that are to be joined with a soldering paste. Tinning the brass is not required or recommended.

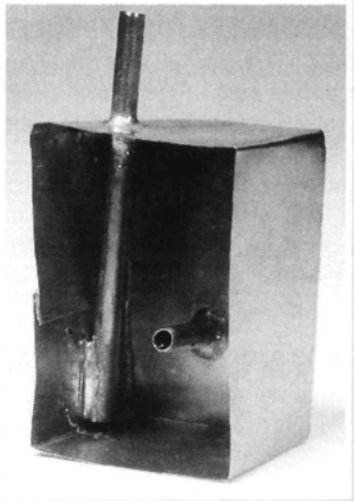
• Soldering brass pipes through .010-inch-thick end pieces. Hold the assembly with pliers or "helping hands," heat the parts, then apply solder to the flared side of the end piece, i.e., to the inside wall of the tank end piece, and allow it to flow around the pipe.

• Soldering sheet-metal seams and joints. The most precise way to transport solder to the work is to place a small drop on the clean soldering-iron tip. Though contrary to standard practice, it's a lot neater, saves weight and gives solid results in this application. Beginners often use far too much solder. Practice using minimum amounts.

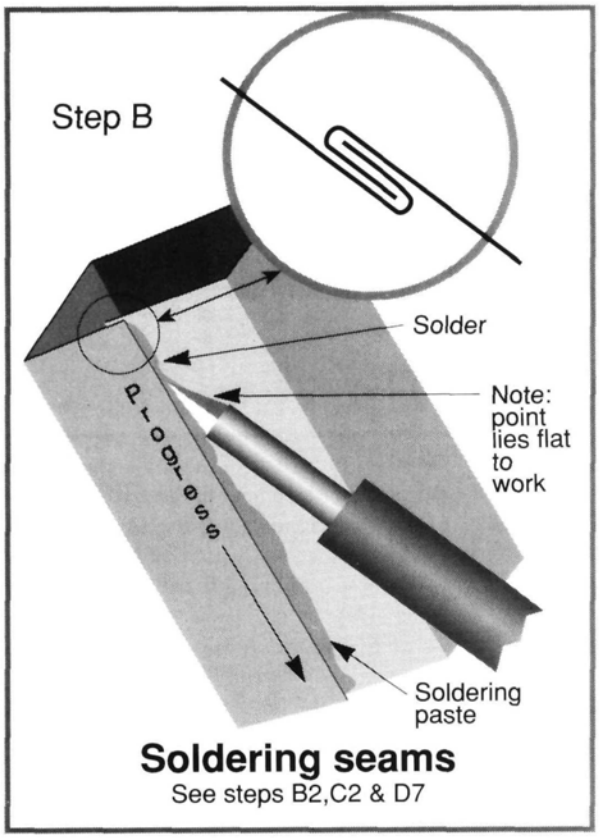
Apply the heated iron (with a drop of molten solder clinging to it) to the metal, and allow the solder to flow from the hot iron to the now equally hot metal. Thin sheet metal does not conduct heat very far and can often be hand held, but *be careful!* Brass pipe and brass end pieces can become super hot and, of course, one drop of molten solder could ruin your whole day. Use handling tools when necessary. Bean bags work well to hold tanks in place while soldering. Wash acid paste off your hands!

Using the proper procedures will cause the solder to flow into the joints almost like water and to be shiny. If an area looks dull or a seam looks dark, chances are great that it will leak. After building several tanks, you won't need to pressure test; you'll know.

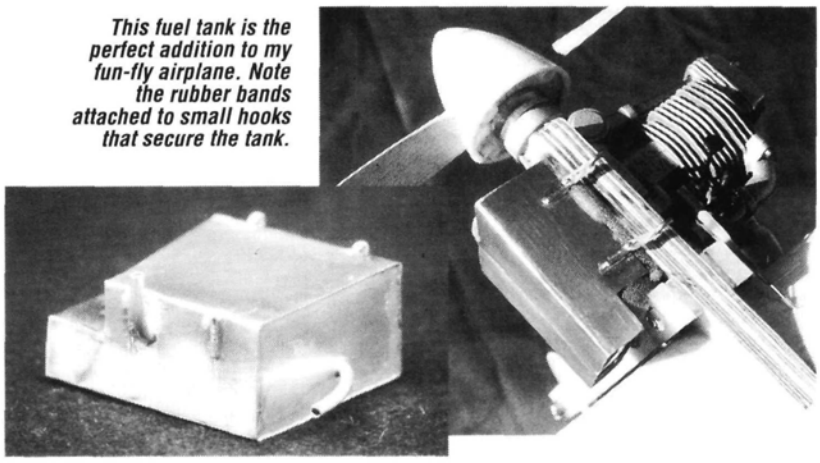

Here, an end piece is being soldered into place.


Note the pressure pipe extending to top and fuel supply pipe (shown without tubing and clunk). The tank has been cut in half and is shown inverted in photo.


Solder the outside of the interlocking seam.



Soldering seams
See steps B2,C2 & D7



This fuel tank is the perfect addition to my fun-fly airplane. Note the rubber bands attached to small hooks that secure the tank.

STEP B—TANK CENTER-SECTION COMPLETION

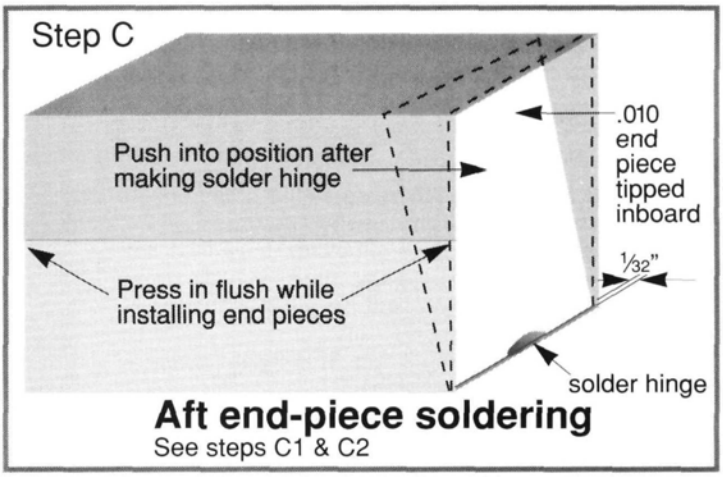
1. Use a straightedge as a bending tool; by hand, fold each of the ⅛-inch bends into a "U-turn." Bend the sheet along the scribe lines to form the rectangle.

2. Interlock the bends (to create the seam); use long-nose pliers to firmly crimp them together. Lightly brush and solder on the outside only.

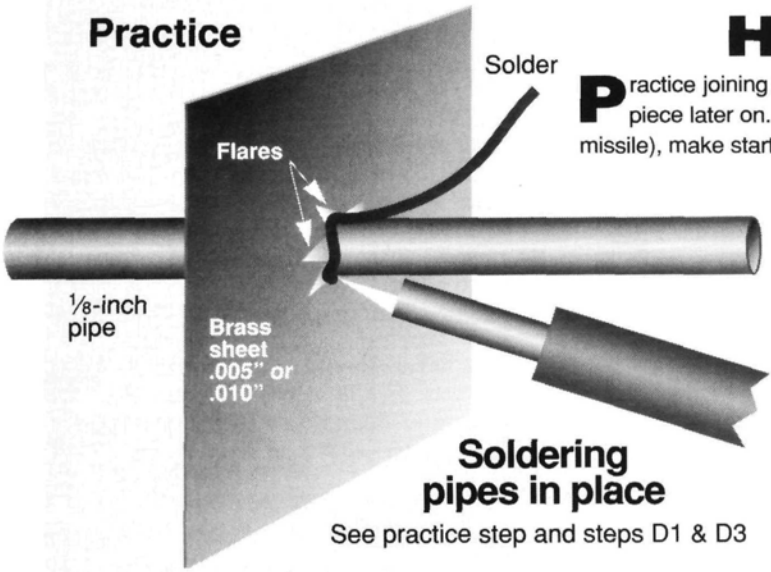
STEP C— AFT END PIECE —.010 BRASS

1. Measure your rectangular tank (smile if it's slightly trapezoidal), and cut an end piece out of .010-inch brass to fit. Note: for round or oval tanks, make a template by pressing the tank body on soft balsa. Then use the soldered tank end (it becomes your template for a perfectly symmetrical tank) to trace a duplicate for the front.

2. Nip the sharp corners off the end piece; trim and file for a snug fit into the opening. Use your fingernail to seat 1/32 inch under the tank rim. At first, this may require several attempts. A common problem is trying to make too tight a fit. Use scissors to trim it down, and if it gets too small, make another. Key to success: position the end piece in place, and maintaining the 1/32-inch margin on one edge, tip the piece inboard, then brush and solder along for ½ inch to make a solder "hinge." From the inside, nudge the part into exact position, and tack-solder around as you complete the soldering of the outside perimeter. A small solder fillet will form at the joint intersection. Do not file it away.



Aft end-piece soldering
See steps C1 & C2



Soldering pipes in place
See practice step and steps D1 & D3

HELPFUL HINTS

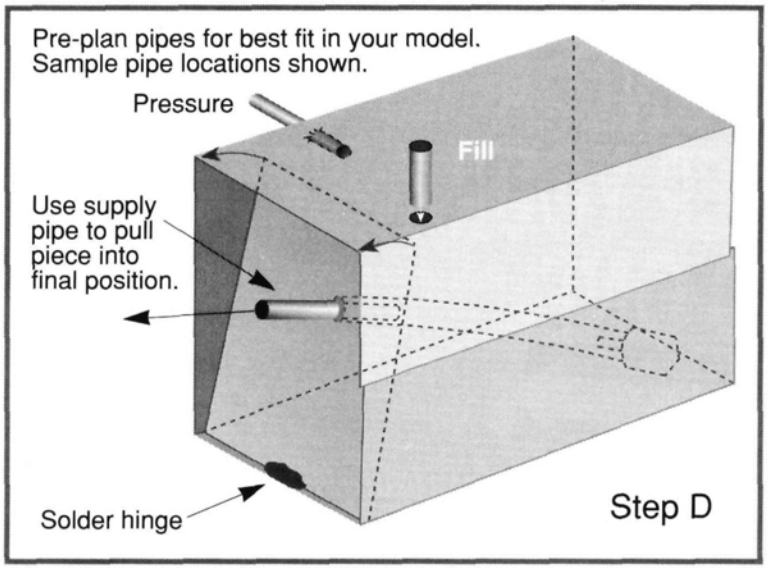
Practice joining pipes through sheet metal several times to avoid destroying a nice piece later on. Using a center punch or a dart tip (that's the business end of a pub missile), make starter holes in some .005 and .010 brass scraps. Use one tip of a long-nose pliers to carefully expand the hole until it's a tight fit for an ⅛-inch pipe. Over-sizing happens at Mach 2, so proceed slowly. *Do not drill these holes. Sharpening the pipe, i.e., filing an even* chamfer around the outside of the end going into the tank, helps obtain the closest fit.

Apply paste; then heat and solder the flared side (inside) of the assembly only. A perfect fillet will automatically form on the front (the outside surface of the tank wall) as the solder flows through. Practice soldering some pipes in place. Nice work!

Scribe technique: lay the scribe over about 60 degrees (even a dull dart works here) before scribing a line. Make several light *passes to form a smooth crease without removing any metal.*

STEP D—FRONT END PIECE—.010 BRASS

1. Before installing the front of the tank, plan and install your piping. You may want pipes (fill, pressure and sometimes supply) to enter through the tank sides, or the top or bottom. They must be installed now. Locate, punch and expand the holes for them as practiced. The pressure pipe must always terminate near the top of the tank. Brush and solder on the inside.
2. Using .010-inch brass, make the front end piece slightly oversized.
3. Locate and properly make holes, and solder pipe(s) through the front piece.
4. Use the pipe(s) as a handle to position and manipulate, and trim for a close fit.
5. Add the pick-up tube and clunk!
6. Now position the piece, and tip inboard. Brush and make the solder "hinge," then use the pipes to pull it into place and complete soldering as in step C2.



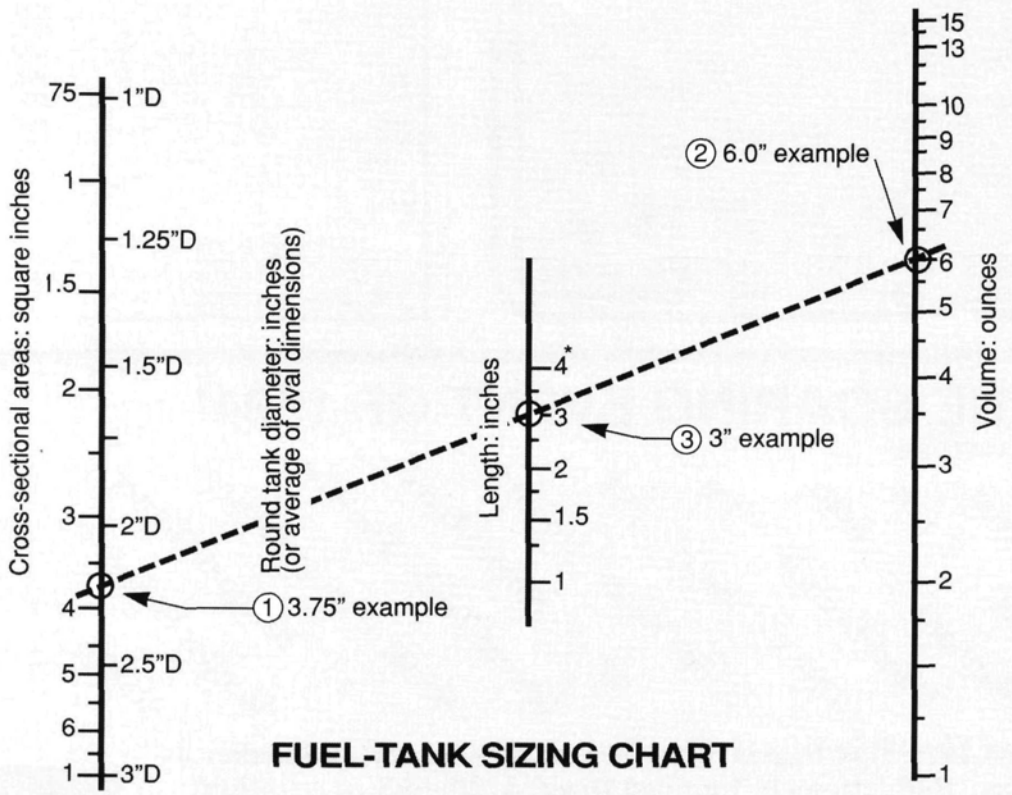
STEP E—TEST AND GO

1. Pressure-test with air while holding the tank under water. Hold your fingers over the pipes, and blow through the fill tube. *Remove the tank from the water before releasing the pressure!* Clean and solder any leaks; re-test.
2. Rosin residue can be picked off with a modeling knife. Polish with steel wool or Brasso (for show). A little clear lacquer or polyurethane will delay tarnishing.

Credits: my son Jay was a great help with ideas and procedures for this article. Our good buddy Scott Williams (a total non-modeler who barely knows which end of a screwdriver to hold) was coerced into following the instructions on his own. He made a very acceptable brass and lead fuel tank. Maybe it's a tad heavy, but we'll fly it the next time we need nose weight!

I found that K&S* products reflect a high degree of quality control. I really enjoy working with them and think you will also. Give them a try.

**Here are the addresses of the companies mentioned in this article:*
House of Balsa, *10101 Yucca Rd., Adelanto, CA 92301.*
Cox Products, *350 W. Rincon St., Corona, CA 91720.*
K&S Engineering, *6917 W. 59th St., Chicago, IL 60638.* ■



FUEL-TANK SIZING CHART

The dashed line is an example of how to find the length of a fuel tank, using the chart shown here, after calculating the area of the tank's end piece and establishing the volume of fuel you desire the tank to carry. The sizing chart relates to square tanks (cross-sectional area of the end piece is indicated on the left side of the scale at the far left) and to oval or round tanks (diameter is indicated on the right side of the scale at the far left). For example, assume:
Width (1.5 inch) x height (2.5 inch) = 3.75 square-inch end-piece area
Desired volume: 6 ounces
1. Mark 3.75 on the cross-sectional area scale.
2. Mark 6 on the volume scale.
3. Read the required length (3 inches) on the length scale.

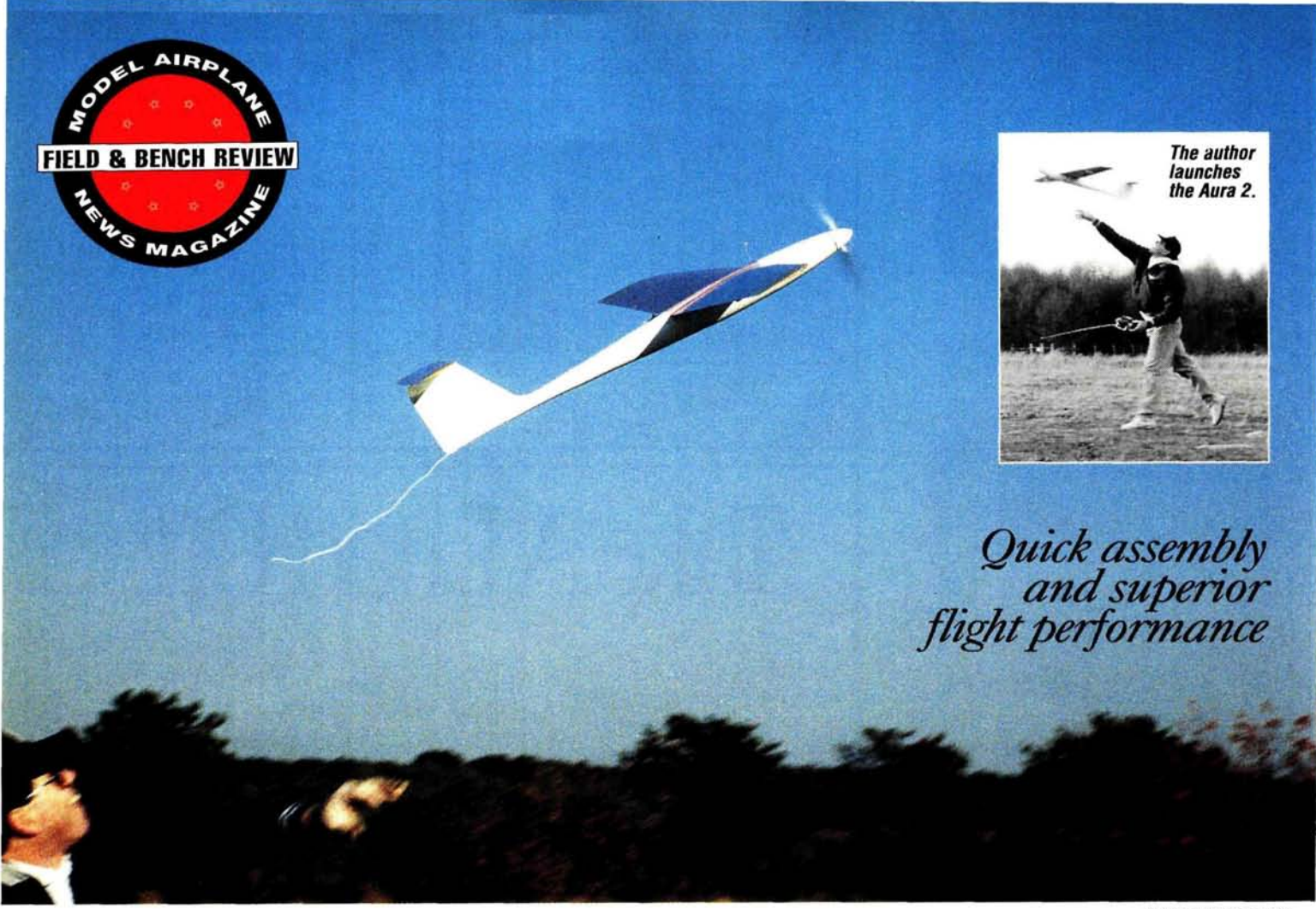
Similarly, the chart can be used in any direction to find area, or to find volume. For example: suppose you want an oval tank to be 4 inches long and to hold 5 ounces. Place a mark at 4 on the length scale, another mark at 5 on the volume scale, then lay a straightedge between the two marks, and read 1¾ inches (diameter) where the straightedge intersects the cross-sectional area scale.

Round tanks (and ovals) can be sized using the diameter scale. To find the overall length of stock needed to create the outside perimeter of a round or oval tank, i.e., the sheet that wraps around, defining the tank's circumference, use this simple formula: [(diameter x 3.14) + ⅜ inch]. The ⅜ inch is added to allow for the interlocking seam, as explained later.

Note: oval tanks facilitate throttle cable and nose-gear cable routing.

***Longer tanks require the splicing of K&S sheets. To make 4- to 7¾-inch-long tanks, use a single-overlap solder joint to join the 10-inch sides of two sheets.**

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW



The author launches the Aura 2.

Quick assembly and superior flight performance

PHOTOS BY TOM HUNT & BOB ABERLE

M.A.P. Aura 2 Sailplane & Aveox Brushless Motor PART 2

Editor's note: in this issue, Grumman aerospace engineer and contributing author Tom Hunt concludes his two-part review of the M.A.P. Aura 2 sailplane and the Aveox 1412/7 brushless motor.

IN THE FIRST installment of this two-part series, I commented that the Aveox* 1412/7 brushless motor and M.A.P. Aura 2 sailplane (distributed by Slegers Intl.*), when married together, form one of the most efficient powerplant/airframe packages this author has ever experienced. Look to that article for an overview of the brushless motor and an introduction to the remarkable composite construction that goes into this sailplane. In this installment, I will discuss final assembly of the Aura 2, installation of the motor and control system, and flight performance.

In the last issue, I noted that the Aura 2's fuselage, with a molded-in vertical tail, is a factory-joined Kevlar/gelcoat lay-up with installed motor mount (a fiberglass front disk). This airframe weighs only 5 ounces, empty. This makes for a tremendously tough, light fuselage (one that can hold up to 27 cells!). Let's move on to the specifics of assembly.

AURA 2 ASSEMBLY

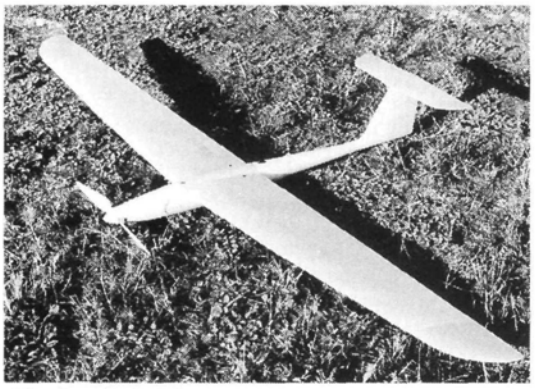
The wing fillet is molded in, and each wing is hand-fitted to match the fuselage. A similar arrangement is used for the T-tail horizontal tail. A small cutout is made in the left side of the vertical tail to install the elevator servo. A small fiberglass patch is supplied to cover this hole, although it has to be painted to match the eggshell white, gelcoated fuselage. (In future kits, this patch will be supplied already painted.)

Hardwood mounting blocks with metal threaded

• by TOM HUNT •

inserts are factory installed to secure the wing to the fuselage in three places: on the forward center line and on each side near the 70 percent wing chord. A hardwood block, for mounting the horizontal tail, is pre-installed, drilled and tapped to match two screws that secure the tail to the top of the fin.

The model has no provisions for a rudder, and none is needed for good flight performance, although one could cut off the rear portion of the fiberglass vertical tail and replace it with a built-up rudder. It would be wise to strengthen the vertical tail with some sort of balsa fin post near the rudder hinge line.



The Aura 2 at rest.

The trailing edge of the wing, where the top and bottom fiberglass layers come together, produces an edge that is so straight and stiff that you could cut yourself on it. Use caution when handling! Sanding the edge back a few thousands inch will dull it slightly but, for the sport flier, it probably won't affect flight performance noticeably. It might also save some Band-Aids!

Hardwood blocks are molded into the wing for the fuselage-to-wing screws mentioned earlier. The screw holes are pre-drilled and countersunk for the metric flathead screws provided. The upper portion of the fuselage is also a part of the wing mold, so no over-wing fairing work is necessary. Out of the box, the wing weighs 16 ounces. There's also a 10-cell version that sports a similar construction, but it's a hollow-core foam wing and weighs almost 3 ounces less (but, naturally, it can't take the stresses produced by a significantly higher cell count).

WING SERVOS

Cutouts and an internal wire trough are provided for the aileron servos and servo wires (two micros required). No servo-bay covers are supplied; however, some white trim-like covering material was provided as covering for the servo in the wing.

The ailerons come cut and hinged. They're the top-surface-hinge type. This type of hinge works well for spoilerons (upward bias), but *not* for flaperons (downward bias), because the lower gap/chamfer, to allow for adequate flap deflection, would have to be too large. Flap and flap-servo cutouts can also be done by the modeler or ordered at extra cost.

FLIGHT PERFORMANCE

• The launch

Steve Kowalski (a serious electric sailplane competitor and flying buddy of mine) hand-launched the model for the first flight (in which I used only 14 cells, to tone down performance) to give me instant control on the sticks. On motor turn-on, the model left Steve's hand without effort and climbed nearly vertically to a comfortable height (to begin trimming). The motor ran for barely 15 seconds before the model became difficult to see! The ride up was smooth. Slight forward stick was needed to make a straight ascent, but was relaxed when the power was turned off. There was no tendency to veer off course (yaw) during that short ride up, nor was there any need to correct roll angle.

• Soaring Flight

After the motor had been powered off and the model pushed over to level flight, the first thing that was noticed was this model was fast! A little up-trim was introduced to slow it down, but its sink rate increased dramatically. The trim was removed, and the model was left to fly at a fairly high speed. On this day, there were apparently no thermals to find, so stall characteristics were assessed during straight flight and simulated thermal riding turns.

Straight-forward power-off stalls at this weight (69 ounces) were abrupt and dropped a wing, but it resisted a spin if elevator control was relaxed immediately. Recovery requires sufficient air speed, and a significant loss in altitude must be expected. When turning too tightly in thermal riding turns, a wing (usually the outboard) dropped violently in a stall, but recovery was swift and positive.

• High-speed performance

As I mentioned, this model likes to fly fast to achieve a good lift-to-drag ratio. Pushing the model into a shallow dive (power off) results in a speed increase that rivals the speeds of ducted-fan jets at full throttle! The control of the model remains solid and trim-free. Just follow the model down to a low level, climb again by just applying a little up-elevator, and watch the model regain at least 50 percent of what you lost with the power still off! Turn the power back on for a few seconds to return to the starting height. Power-on high-speed passes actually seem slower than power-off. The aircraft behaves well, power-on, in level flight, but be ready with a little forward stick to prevent it from ballooning.

• Low-speed performance

Stalls should be avoided unless sufficient altitude is present. This model should not be flown slowly unless the intention is to land. That's not to say that this model *can't* be flown slowly. The application of a little "spoilerons" (about 5 degrees of deflection) will help prevent the tips from stalling during landing. Landing speeds are still high for a "sailplane," even with spoilerons deployed, but one has to remember that this model was "optimized" for the F5B mission, not for shooting touch-and-go's.

The spoilerons, with up to 30 degrees of travel (⅜ inch at the inboard trailing edge), do not require elevator compensation to keep the model trimmed. At this high spoiler deflection, roll control is reduced, but still adequate even in gusty conditions. The model assumes a slightly nose-up attitude and settles onto the field much more quickly than without them. If you have a large flying site with long over-run capability, the spoilerons may not be necessary. They do allow experienced modelers to "spot land" the model much more precisely.

• Aerobatics

Although it isn't an aerobatic airplane, loops and rolls are smooth and precise. Inverted flight requires only a touch of down-elevator. Because this model is stressed to carry 27 cells, it's unlikely to suffer wing or tail failure when doing high-G or violent maneuvers. The real hot-dog sport flier will find this model to be more of a high-powered aileron ship than a sailplane.

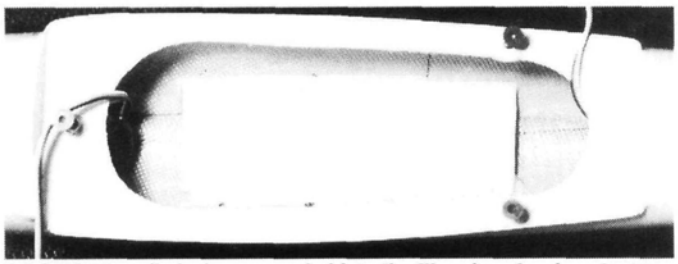
• Higher vs. lower cell counts

On 16 cells and the Aeronaut or Freudenthaller 11.5x7 folder, climb rates are about 2,000 feet per minute. The extra two cells do not seem to adversely affect gliding performance. The motor can only be run about 30 seconds before the model becomes too difficult to see. The amp draw is high (in excess of 40 amps), so run times are low on 1000 to 1100mAh packs.

On 12 cells and the Aeronaut 14x8.5 folder, climb angle is steeper, but slower than with the 11.5x7 on 14 or 16 cells, but—more important—the reduced weight starts to enhance thermal performance. This prop/cell combination favors light-air/low-wind days, but the higher cell counts and smaller props favor high-winds/strong-lift days. It's nice to have this large (and efficient) power/speed range in one motor/aircraft combination.

• Aveox/Aura 2 as a Class B ship

On 12 or 14 cells, a 30-second motor run and light to moderate thermal activity, I've routinely had the required 8-minute flights for Class B electric sailplane events. In the allotted 30 seconds, this model flies higher than any other competitive sailplane I own or have flown. Its thermal performance is not great at these higher weights, but with the great speed of the model and all that height, thermal hunting can cover a large area with a minimal loss in altitude. Also, the higher speed of the model allows one to get out of sink areas faster. This model, in this configuration, is a good competitor (in the right hands) in Class B electric sailplane.



A false bottom (balsa) was epoxied into the fiberglass fuselage to provide a flat surface for up to 16 cells.

ELEVATOR

The horizontal tail/elevator is similar in construction to the wing, but has much less carbon fiber between the foam-core and glass skin. The elevator is pre-hinged on top like the ailerons, and a small plastic-lined brass tube is cemented into the elevator core about ⅜ inch behind the hinge line. This serves as the pushrod attachment to the elevator servo. Two hardwood blocks, drilled and countersunk, are molded into the tail on its center line to make the tail easy to remove for transportation.

INSTRUCTIONS

No written instructions are given. Quite frankly, none is necessary, because of the model's extensive prefabrication. Full-size plans are supplied; they're annotated in French, but any competent modeler will understand the drawings without having to read the words! It must be assumed by the manufacturer that only the sailplane-savvy modeler would attempt this model and that he would already know how to install the radio and motor.

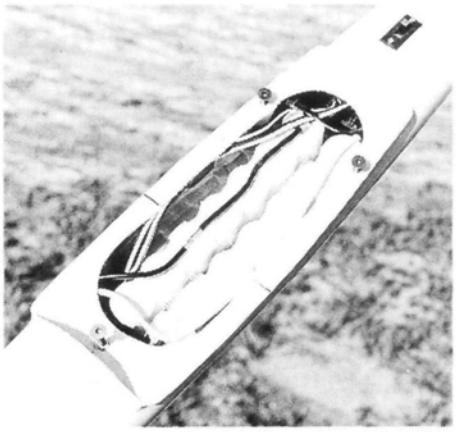
RADIO INSTALLATION

Without written instructions, I decided to install the elevator servo/pushrod in the fin first. The cutout in the fin was a bit too small to comfortably take the Tower Hobbies* TS-11 microservo in the tail. The hole was enlarged about ⅛ inch on the aft edge and about 1/16 inch on the top edge.

I also had to shave the pre-installed balsa vertical tail-fin post a bit. An elevator pushrod made of music wire had been bent 90 degrees, about ⅜ inch from one end, to form an "L." This is the end that was to go into the tube buried in the elevator.

I slightly bent the servo end of the pushrod to get the wire out to the output arm on the servo and keep the remainder of the wire on the fin's center line. A clevis adapter is attached to the wire, which is of an appropriate length to reach the loosely fitted servo. The pushrod "L" end exits the top of the fin through the slot provided. A metal clevis connects the pushrod to the servo arm.

With the horizontal tail's elevator slipped onto the "L," the tail is bolted into position.



The 14 cells (1100mAh) fit easily inside the cavernous fuselage; the RX is behind the batteries; the RX switch is behind and above the RX.

The clevis is attached to the floating microservo. The servo is then attached to the right-hand wall of the fin using your favorite method, being sure that the elevator and servo are both at neutral.

SECURING A SERVO

I have a little trick for securing a servo to a wing skin or a fiberglass wall such as this. I wrap the servo with one layer of high-quality clear Mylar tape. I then roughen it slightly with 320-grit sandpaper on the side about to be glued.

I mix an appropriate adhesive—5-minute epoxy, in this case—and secure the servo to the wall. If I ever have to remove the servo from the vehicle, a little persuasion will get it off the tape or the tape off the epoxy. Pulling the tape off leaves the servo looking like new!

HORIZONTAL-TAIL FIX

I have to mention a bit of trouble I had with the horizontal tail. The tail comes drilled for two, metric, flat-head socket screws. When I first installed the tail, I noticed that it was very crooked. Close examination showed that the screw holes in the fin were perfectly on the center line, but the aft hole in the tail was slightly off center (based on a line showing through the translucent fiberglass skin). I "oversized" the hole and the countersink until the tail could be aligned straight. I then "waxed-up" the screw and the top of the vertical tail. I started the aft screw into the fin by a couple of threads and "backfilled" the oversize hole with 5-minute epoxy. I brought the screw down to its final position, wiped off the excess epoxy and let it set. When it had cured, the screw backed right out, the tail came off and I had a perfect clearance hole and countersink—again, with the tail now straight.

AILERON SERVOS

An internal wire trough in the wing (about 50 percent chord) is provided to get the aileron servo wires out to the cutouts. However, at the outboard end, the trough "dead-ends" against a fiberglass wall in the servo bay. This will have to be removed to get the wires out to the servo. From the inboard (on center line) hole, I pushed a 1/16-inch music-wire rod through the trough out to the cutout. I taped my aileron servo wire (no connector) to the music wire and pulled it through the trough. This was so easy it was scary! (Something has to go wrong soon, or this isn't a model airplane!)

For added strength, I decided to install metal gear Futaba* 3002 miniservos in the wings. They are about the same size as the S-133s, but they're a bit wider, and they did

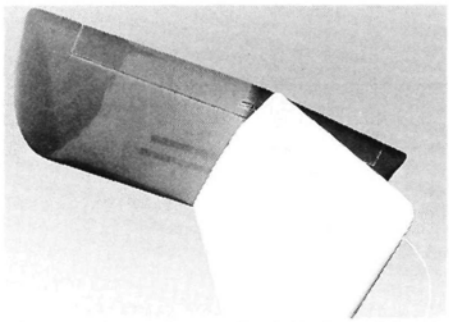
SPECIFICATIONS

Model name: Aura 2
Manufacturer: M.A.P. (France)
U.S distributor: Slegers Intl.
List price: $675
Wingspan: 75.6 in.
Wing area: 500 sq. in.
Weight: 69 oz.—Aveox 1412/7 and 14 1000mAh cells
Wing loading: 19.9 oz. per sq. ft.
Airfoil: Sd 7003
Wingtip washout: none
Fuselage length: 42 in.
No. of channels: 3 minimum (spoileron mixing recommended)
Construction: Kevlar fuselage, glass/carbon/foam-core wing and tail. Optional accessories: lighter, hollow-core wing for 10-cell operation (no extra charge), spinner/prop-blade holder (list price: $30).

Features: gelcoated fiberglass fuselage does not need painting; one-piece, bolt-on, foam and glass wing with pre-hinged ailerons; foam and glass bolt-on horizontal tail with pre-hinged elevator; special metric socket speed wrenches provided; wing and tail colors molded in. Pre-bent elevator pushrod and aileron pushrod with clevises are provided.

HITS
- High-quality prefabricated parts.
- Lightness of component parts.
- Spacious fuselage.
- Exceptional flight performance (even on as little as 10 cells).
- Durable construction.
- Special metric wrenches included.

MISSES
- Pre-assembled tail slightly crooked (easily corrected).
- Color scheme could offer greater visibility at altitude.



The elevator pushrod exits at the top of the fin and engages a tube epoxied into the elevator. The RX antenna exits at the lower fin.

not entirely fit within the wing's thickness. I made small balsa fairings to solve the problem of the protruding edges of the servos forward and aft. These were just "double-back-taped" on and covered with Mylar tape to prevent moisture from getting to the wood.

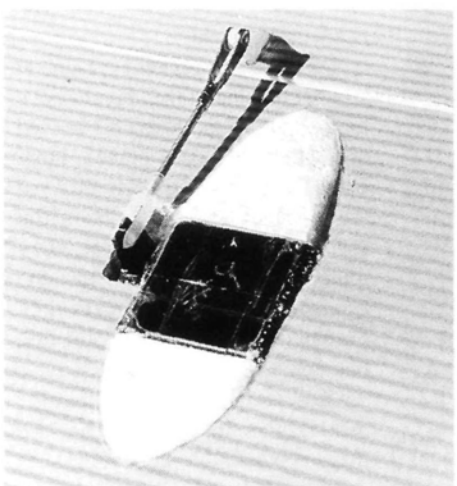
I left the pushrods "unfaired" (exposed to the airflow) because nothing was offered in the kit to cover them.

RECEIVER

My Futaba FM Super 7 receiver was installed in the floor of the fuselage with Velcro®-brand fastener just behind the wing trailing edge. Two short (6-inch) aileron extension cables were plugged into channels 1 (aileron) and 6 (flap) to facilitate wing-servo hook-up. Note: this 2-channel hook-up for the aileron servos is for the use of spoilerons. If you choose to fly with just ailerons, just plug a Y-harness into channel 1.

I installed the receiver on/off switch just above the receiver in the top of the fuselage, behind the wing. The receiver antenna passes through the length of the fuselage and out through the bottom of the vertical tail. (You provide the hole and make sure there are no sharp edges to cut through the antenna.)

I installed the receiver battery (4-cell, 270mAh) in the nose, just behind the motor on the fuselage floor, with Velcro®-brand fastener.



My Futaba S3002 metal-gear aileron servos protrude slightly; I faired over the edge with balsa and taped on the fairings.

MOTOR/SPEED CONTROLLER INSTALLATION

The Aura 2 nose has a factory-installed fiberglass motor plate that's drilled and countersunk for what I assume are some of the more popular European motors. Even with five holes, there was still plenty of room (and strength) in this plate to add two more for the Aveox. As a precautionary measure, I did fill (with epoxy) one of the factory holes that was close to one of the new holes.

Attaching a suitable folding propeller and spinner (Carl Goldberg* 1¾ inches) to the shaft is left to modeler. I had a Graupner* pinch-clamp type handy (supplied with the motor from Aveox), but it placed the spinner backplate nearly ¼ inch away from the motor plate—very unsightly! Aeronaut offers a 5mm setscrew-type prop adapter (part no. HLAN2409, available from Slegers Intl.) that I suspect will get the spinner backplate much closer to the fuselage. If you wish, for an additional $30, you can buy a spinner/prop blade holder especially designed for the Aura 2 from Slegers.

The wires exiting my motor were extremely stiff (14 gauge and a low number of strands) and very short (about 2 inches). The wires exiting the speed controller were softer, but just as short. There certainly is plenty of room in the Aura 2 for the speed controller right behind the motor, so installation in this vehicle poses no problems. *(Note: Aveox has informed me that all future motor/connector wires will be of the soft variety and will be much longer—without the color-coded connectors installed, but they'll be provided.)* Do *not* wrap the speed controller in foam. Just use Velcro®-brand fastener to attach it to the inside of the fuselage.

Last, the motor battery (12 to 16 cells) fits comfortably under the wing. Since the bottom of the fuselage is curved, I decided to install a "sub"-floor to provide a flat surface on which to mount the batteries. I started with a piece of ½x2x7-inch soft balsa and shaped the bottom until it closely fit the inside of the fuselage under the wing. I glued it into place with a slurry of epoxy and lightweight filler. I then glued, on top of the wood, two strips of the "fuzzy" side of Velcro®-brand fastener. This platform easily holds 16 cells securely, even during the hardest of landings.

The motor battery packs are assembled in the flat configuration, with cells standing up when using 1000mAh capacity and lying down when using the 1400 to 1700mAh variety. The CG shown on the plans (3.3 inches aft of the wing leading edge) is a good place to start for test flights.

Flying weight with two SR* 7-cell 1100mAh packs (hooked up in series) and an Aeronaut 14x8.5 prop is 69 ounces. As you see in the motor/prop tests table (see Part 1, April '94 issue, page 62), in this configuration, the model has nearly a 1:1 thrust-to-weight ratio! There's nothing left to do at this point except fly! (see "Flight Performance" sidebar).

Moments before launch; no need to toss like a javelin, this airplane rockets out of your hand!

CONCLUSION

The Aveox/Aura 2 merger is a very fine one. Seasoned electric fliers who aren't accustomed to hot performance should not be intimidated by this airframe/powerplant combination. The Aura 2 flies well at weights as low as 50 ounces and as high as 72 ounces. The Aveox is a set-it-and-forget-it motor; when it's handled, installed and used properly, the need for maintenance is practically nonexistent.

**Here are the addresses of the companies mentioned in this article:*

Aveox Inc., *P.O. Box 1287, Agoura Hills, CA 91376-1287.*

M.A.P.; *distributed by Slegers Intl., Rte. 15, Wharton, NJ 07885.*

Tower Hobbies, *P.O. Box 9078, Champaign, IL 61826.*

Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718.*

Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651.*

Graupner; *distributed by Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027.*

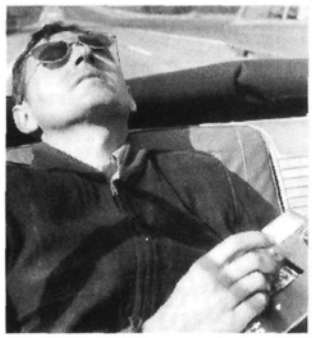
SR Batteries Inc., *Box 287, Bellport, NY 11713.* ■

HAL DeBOLT

MAYNARD HILL'S RECORD-BREAKING FLIGHT

MAYNARD HILL'S 1965 record flight was a great experience; not only was I privileged to officiate during it, but I also learned what's involved in setting out to fly an R/C model for nearly 200 miles nonstop. Thirty years ago, that was a much bigger deal than it might be today!

It all began with a surprise call from Maynard, who asked me whether I'd be available to act as a contest director during a cross-country record attempt starting from Buffalo the *next day*. My immediate reaction was, "What the devil are you talking about, old friend?" Maynard explained that Malikov of Russia had set an R/C cross-country record of 155 miles the year before. Earlier in '65, Maynard had set a closed-course distance record of 280K in 5:41. Under the right conditions, Maynard thought, he could eclipse the Russian record in less than four hours using the same "Stretcher" model. The only problem would be to find nearly 200 miles of open country and an unobstructed highway. In that era, the New York State Thruway was about the only possibility—in the East, at least.



It was cold operating the Quadraplex transmitter in the open convertible at 65mph as we drove on the thruway!

My next question was, "Why the Buffalo site?" Maynard's John Hopkins colleague, Ray Cramer, had prevailed on New York's Governor Rockefeller and the State Thruway Authority to allow us to attempt the record on that unrestricted, high-speed road. That in itself apparently took some doing, considering safety and all. Somehow, they managed it!

UNDER THE WEATHER

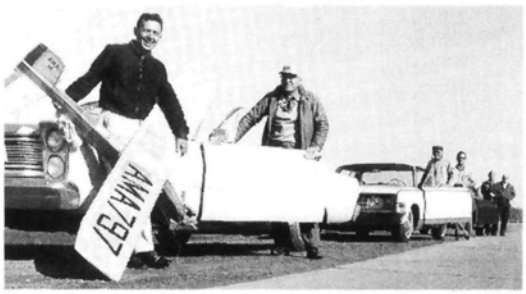
I pointed out that it was October and the flying season had long been over in that area, plus it had been raining cats and dogs for days. Maynard explained that he needed a good tailwind for the flight; the Stretcher's flying speed was only 45mph, and he wanted a ground speed closer to 60mph. Weather records indicated an expected 15 to 20mph west wind that time of year in western New York, and that helped Maynard to choose the date.

I wondered about all the rain. The latest weather report suggested that the storm front that had been hanging over the Northeast would have moved out by the next morning. Can you imagine three crazy modelers loading a convertible, driving for nine hours in a storm—getting soaked to the skin—to go flying in a drenching downpour?

MAKING PLANS

Maynard indicated that all preparations had been made except for finding a launch site.

At the Batavia pasture, Maynard's Merco .61 has been "tached" and "needle-set" for a 183-mile flight. Ray Cramer and Maynard look on while I double-check the setting.



Success! Ray Cramer approves as Maynard displays his Stretcher at Canajoharie; deBolt, Blackburn, Wells and Havill in the background were the officials.

He asked me to scout the local thruway area for a suitable spot. What he didn't realize was that, as in most metropolitan areas, the thruway in the Buffalo area is very congested. There just was no open area near the usable Buffalo interchange. The best site would be the Flying Bison's field about two miles away. We decided to begin at the Batavia interchange—25 miles east of Buffalo and in a much more open area.

Preparing for a record flight involves more than developing a capable model and preparing for a Sunday flying session. You have to decide that you're going do it and at a *specific time*; then you must file the paperwork, get yourself organized and coordinate your helpers, the officials and, in this instance, the New York State Thruway Authority. The bottom line is: you had better be right!

I was asked to meet everyone at a motel that night; the apprehensive looks on their faces when I arrived spelled trouble. The plane's large loaded fuel tank had been removed from the model and laid on the floor of the trunk. When they unloaded it, they noticed that the trunk floor was soaked with fuel. Fortunately, the tank was still full, but the spare can had leaked.

After we had made sure that the model was in good shape, we inspected possible launching sites to be sure that the Batavia choice

was best. If local residents had noticed us tramping around fields in the midnight rain, they surely would have wondered who the nuts were! A stop at the weather bureau was encouraging; the latest report indicated clear skies and a 15mph west wind by morning. All systems looked like go!

We needed three cars for the attempt. I would act as contest director in mine, with Don Blackburn as an observer. Ken Havill of the NYS Thruway Authority would pave the way for us in a thruway vehicle. Ray Cramer would drive his Ford convertible, with the AMA's George Wells as an observer, and Maynard would pilot the Stretcher from the back seat. As it turned out, we could have arranged it better; the temperature was in the low 50s—almost unbearable in the back seat of an open car.

We rendezvoused with Mr. Havill at the Batavia interchange, and after a short search, we found open pastureland within a mile of the tollbooth. We checked with the owner, Mr. Hall, who told us that we could launch the plane from his property if we wouldn't disturb his cows. We assured him we would not!

THE RECORD FLIGHT

The time had been set for 11 a.m. The Merco .61 engine was warmed up. From experience, Maynard had learned to set the needle using a tachometer, so he set the desired 5,400rpm, and I launched the Stretcher on its epic journey. After we had made a couple of laps to ensure that all was well, Mr. Havill lead us to the tollbooth at the thruway entrance. Then Maynard pointed the Stretcher east (it was at about 1,500 feet), and we were off and running!

Actually, for a model accustomed to long flights, this flight was rather academic until the last few miles—much more so than the preparation! Maynard found that the turbulent air beneath the clouds required constant piloting, but it was smooth sailing in the blue sky between them. The needle on the car's speedometer was pegged at 65mph most of the time, but as we went downhill, it had to be up to as high as 80mph. Somehow, Maynard managed to endure the cold in the open car, and the first 75 miles were covered in a little more than an hour.

To break Malikov's 155-mile record by the required 10 percent, our goal was the Canajoharie interchange, 183 miles from Batavia. At about the 170-mile point, the Stretcher started to lose altitude; obviously, power was way down. You can imagine our apprehension as flight speed eventually slowed to only 25mph, and only about 200 feet of altitude remained with the goal only 5 miles down the pike! On that highway, it was good that we had the thruway escort vehicle!

During the slow-down period, the Merco had been leaving a smoky trail that Maynard attributed to its "cooling off." Guessing that he could heat it back up by putting a load on it, he put the Stretcher into a nose-high attitude, increasing drag and forcing the engine to work harder. In a miracle of miracles, after about five minutes of this, the power came back and, with it, the necessary altitude. The rest of the way to Canajoharie was no sweat.

On arrival, another problem arose: where to land within the required 500 meters (the interchange was in the middle of the village, so to speak). While Maynard went into a holding pattern, I scouted for a possible landing spot. Happily, I found an area on the opposite side of the tollbooth, and Maynard was able to clear the surrounding trees and dump the Stretcher in the middle of it. All was well except for Maynard's cherished prop!

You can imagine our jubilation over our success (and we were even happier when we warmed up while we enjoyed great New York steaks at a local restaurant). For Maynard, it was another tough job well done! ■

SENIOR PATTERN ASSOCIATION

The Senior Pattern Association (SPA) has been gathering steam with three or four meets in the Southeast and reports of activity in other areas, such as Detroit, last season.

Flight line at the '93 SPA Masters; John Fuqua, Mickey Walker and Ron Van Putte's OT Kirklands "A-6 Intruders" in foreground.

We have a report about the Masters Meet from Mickey Walder, SPA president. Nearly 30 contestants competed in Smyrna, GA, for a fine array of trophies. The SPA has two categories, and they use pre-'60 aircraft and rules. The events are divided into three age groups: 40 to 50; 50 to 60; and over 60. Obviously, only those who have been around for a while are eligible!

Darby Dozier prepares his O.S. .60-powered "Kaos" for flight at the '93 SPA Masters meet.

The weather was nearly perfect, as were the banquet, the camaraderie and the food. Sure sounds great! Interested in participating? Contact Mickey Walker, 3121 Northview Pl., Smyrna, GA 30080.

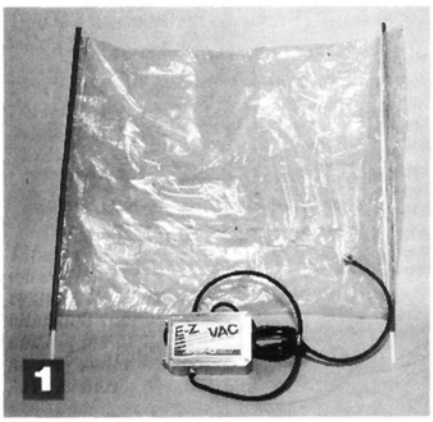
Speaking of OT R/C organizations, the Vintage R/C Society is also active and continues its fine newsletter, which is edited by former *Model Airplane News* editor, Art Schroeder. The latest issue reports that Selinsgrove '93 was a great success, with 48 OT'ers flying an equal number of vintage aircraft (several with the original "rudder only")! It's a great place to see where we came from! For information, contact John Worth, 4326 Andes Dr., Fairfax, VA 22030.

HOW TO

Vacuum-Bagging Rotor Blades

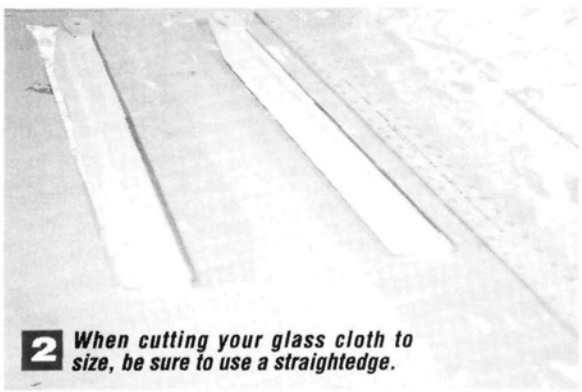
Homemade and contest grade

by A.E. STANLEY



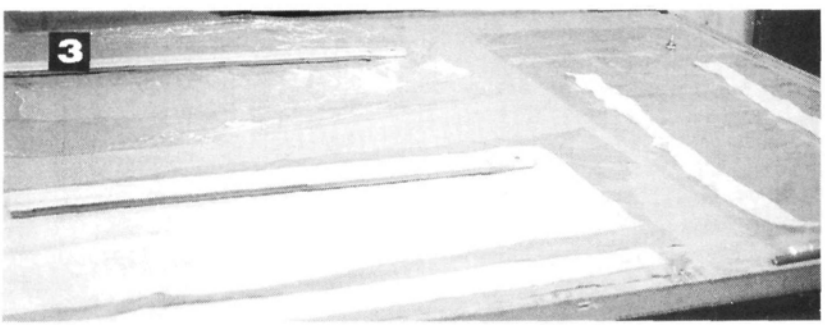
This is the ACP vacuum-bagging system. Note the clips that seal both ends of the bag; no clay sealant needed here.

OVER THE PAST few months, the subject of fiberglass blades has become a very hot issue among sport fliers. Articles have been published about the benefits of using fiberglass blades and how to glass your own blades. I've glassed many sets of blades; they seem to fly better, and they also give me a sense of pride that I did it myself.



2 *When cutting your glass cloth to size, be sure to use a straightedge.*

PHOTOS BY A.E. STANLEY



Before mixing the resin, lay out all the materials so that they'll be within reach. When you start to spread resin, your hands will be a mess!

NEW TECHNOLOGY

Well, just as with every other aspect of R/C, technology has a way of making things better and, sometimes, a little easier: enter the vacuum-bag system. Enlightened sailplane fliers have known about it for several years, but advertising doesn't target helicopter fliers, so many of us have never heard of it.

I read about vacuum-bagging in *Model Airplane News* and thought it would be perfect for laying up my blades. I ordered the Aerospace Composite Products* E-Z Vac system and eagerly awaited its arrival. It consists of a vacuum pump, a roll of bagging material (the bag itself), a very nice set of clips for each end of the bag and a piece that you attach to the bag to allow the hose from the pump to slip right on.

In a few days, I received the bagging system and then sat down with the directions. (I don't know when it happened, but I've somehow got into the habit of reading directions before I use a product.) I laid the items out on the bench and assembled the system. This is very easy and really does not require explanation.

GETTING READY

The first step is to make sure that you have a good set of wooden blades that have been weighted and CG-corrected and are ready to cover. The photo shows a set of Tech Specialties* Phoenix blades. (Tech Specialties is a fine source of blades.)

The next step is to cut the glass cloth to fit the blade. I like to use light cloth ranging from 1.4 to 2 ounces. To fit the cloth, measure as follows:

- Measure the length of the blade from its tip to the edge of the blade grip, and allow ¼ inch hangover at each end. That's how long the cloth should be.
- Measure the blade's chord, double that number and add ½ inch. That's how wide your cloth should be.

Although there are many ways in which to cut fiberglass cloth, I've found that using a rotary cutter and a straightedge is the easiest. A rotary cutter is basically a small, razor-sharp pizza cutter (also available from Aerospace Composite Products).

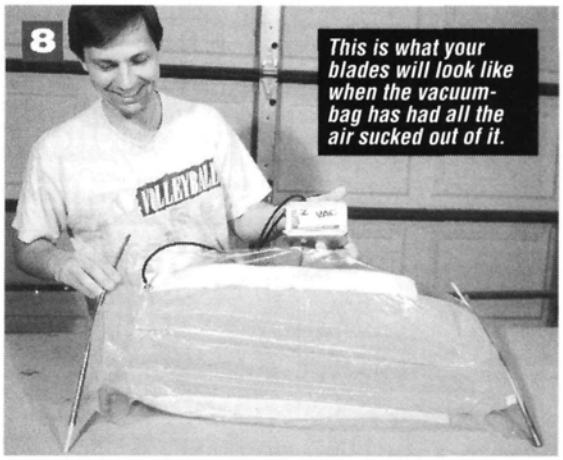
Wrap the glass cloth around the blade, and make sure that the piece you've cut will work. Start at the

You'll need mixing cups, mixing sticks and a foam paint applicator (to apply the resin).

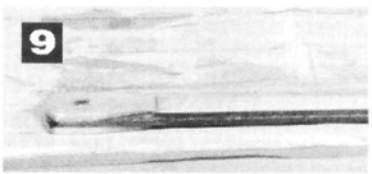
My flying buddy Charlie does the honors of mixing the resin. (They're his blades, so why should I get messy?)

When the top of the blade has been covered with resin, the upper layer of the sandwich is laid on.

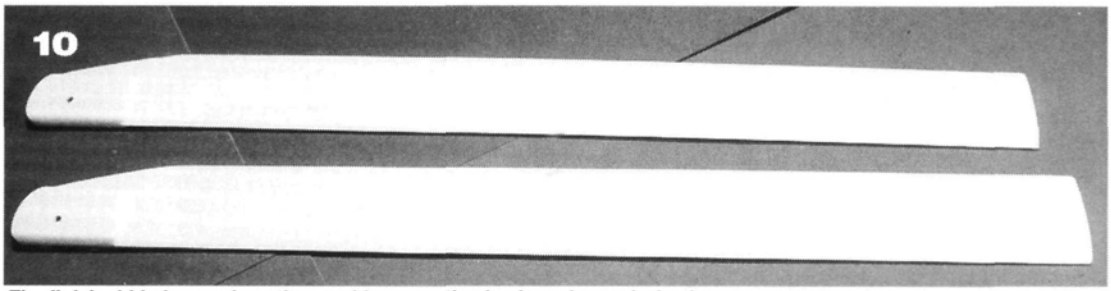
When the sandwich is in the bag, seal the bag at both ends.



This is what your blades will look like when the vacuum-bag has had all the air sucked out of it.



Note how the peel-ply is already soaking up the extra resin.



The finished blades are beauties, and because they've been bagged, they're extra strong.

trailing edge, go around the leading edge and back to the trailing edge. At this point, you should have about a ¼-inch overlap on each side. There should also be ¼ inch of glass cloth hanging past the tip of the blade.

If the cloth seems to be the right size, you're almost ready to get messy! First, prepare the vacuum bag. For obvious reasons, I like to have everything ready before I mix the resin. Basically, you're making a rotor-blade sandwich and putting it into the vacuum bag. When sandwiching the materials, I've found that the following order of application works best: nylon cloth, peel-ply or Mylar, rotor blade with glass cloth, peel-ply or Mylar, nylon cloth.

With regard to the finish on the blades, there are two ways to go:

- covering the blade with Mylar for a glass-smooth finish;
- using peel-ply to produce a textured surface.

I prefer the peel-ply because, after some light sanding, it's a good surface for painting, so that's the method I'll describe here. (Mylar and peel-ply can both be obtained from Aerospace Composite Products.)

To make your "sandwich," you'll need two pieces of nylon cloth, two pieces of peel-ply and two pieces of light plastic (a trash bag cut in half). Cut the nylon cloth and the peel-ply so that there are at least a few inches of overhang on both sides of the blades and past both ends.

Prepare the first part of your sandwich by laying down the materials in the following order: plastic sheet, nylon cloth and peel-ply. Set aside the other pieces in reverse order so that you'll easily be able to take hold of them (your hands will be covered with resin).

POINT OF NO RETURN

The moment of truth has come. It's time to mix the resin. I've been successfully using E-Z* LAM finishing resin. It works well, and I've also heard excellent reports on Pacer Technology's* Z-Poxy finishing resin. The amount of resin to be mixed will vary with the size of the blades you're working with. You'll need approximately 2 ounces per blade, but do yourself a favor and mix more than you think you'll need. Mixing resin is no fun when you're halfway into the job. I also like to wear surgical gloves for this job; cleanup is then a simple matter of throwing out the gloves.

Spread the resin over the blade with a foam paint applicator. Entirely cover the side of the blade, and set the applicator aside. Carefully lay the glass cloth down onto the resin, and line one edge of it up with the trailing edge of the blade. Don't forget the appropriate overhang.

(Continued next page)

ROTOR BLADES

At this point, I use a couple of old baseball cards to squeegee out any bubbles or wrinkles in the cloth, working from the center out to both ends. With that finished, turn the blade over, set it wet side down on the peel-ply and repeat the process on the other side. Repeat this for the second blade.

You should now have both blades covered with cloth and resin and lying on the peel-ply. Try to space the blades so that there's an equal amount of space from the edges of the peel-ply on both sides and between the two blades. Lay the second piece of peel-ply over the blades, and cover that with the nylon, which will wick up any excess resin. Finally, cover the blade with the plastic, which will make it easy to pull the sandwich into the vacuum bag. Without the plastic, the resin will wick through the peel-ply and nylon and stick to the bench.

BAGGING YOUR BLADES

To place the sandwich inside the vacuum bag, lay the bag at the end of it, reach through the bag and pull the sandwich inside. I like to put a strip of felt on either side of the sandwich. It acts as a manifold and allows the vacuum pressure to be equal throughout the bag.

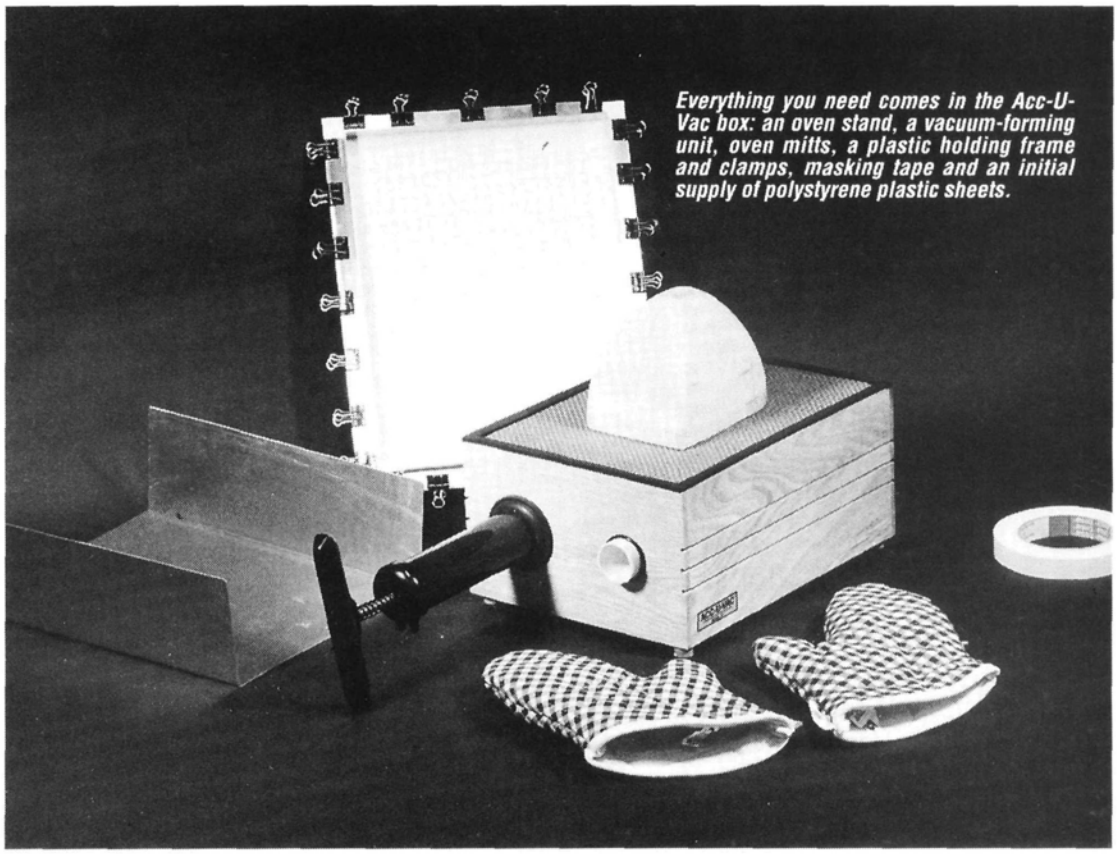
With the sandwich in the bag, seal the openings with the provided seals, attach the hose to the coupler, and plug in and turn on the pump. I've found that wrapping the bag in an electric blanket cuts the curing time in half, but I still recommend that you let the blades sit overnight.

When the resin has cured, remove the sandwich from the bag, and finish the blades. When removing the nylon and the peel-ply, be careful not to damage the blades. I like to let the blades sit for another day before I start to sand them. The nice part about vacuum-bagging is that very little sanding is necessary. That's the purpose of using the bag; a little touch-up sanding with 220-grit sandpaper is usually all that's needed. After the blades have been sanded, prime and paint them as you usually do.

I hope that you'll try this method of glassing rotor blades because it's very easy and produces a fine set of blades. I've found that the vacuum-bagged blades perform much better and also hold up longer than ones that have simply been covered. Happy flying!

**Here are the addresses of the companies that are mentioned in this article:*
Aerospace Composite Products, *P.O. Box 16621, Irvine, CA 92714; (714) 250-1107.*
Tech Specialties, *218 Vernon Rd., Greenville, PA 16125.*
EZ; *distributed by Hobby Shack, 18480 Bandilier Cir., Fountain Valley, CA 92728.*
Pacer Technology & Research, *9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.* ■

PRODUCT REVIEW



Everything you need comes in the Acc-U-Vac box: an oven stand, a vacuum-forming unit, oven mitts, a plastic holding frame and clamps, masking tape and an initial supply of polystyrene plastic sheets.

Appian Productions

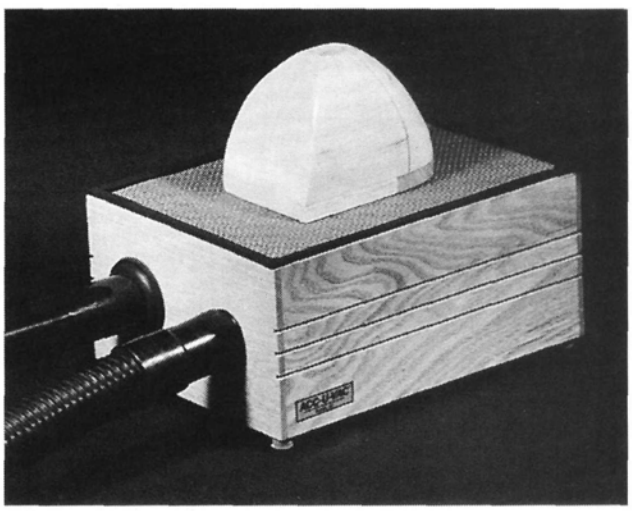
Acc-U-Vac

Top-quality vacuum-forming machine

By JEF RASKIN

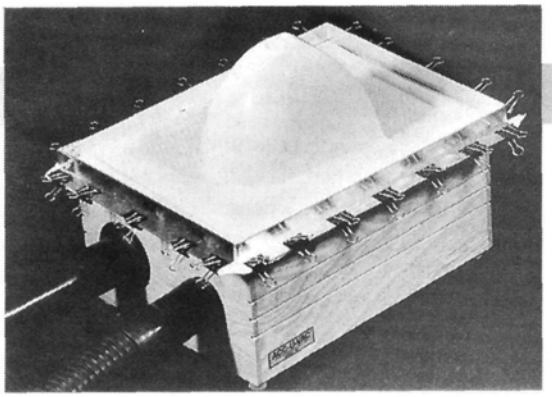
IN A WORLD full of shoddy products made of ticky-tacky with a just-good-enough-to-get-by attitude, it's nice to run into a product such as the Appian Productions* Acc-U-Vac Model 227 vacuum-forming machine. Well-finished and solidly made, it comes with all the little bits and pieces you'll need to do the job and an instruction manual that will help you obtain good results. The Model 227, a two-stage vacuum-forming machine, can quickly turn out well-detailed, vacuum-formed cowls, wheel pants, canopies, air scoops, fairings, fillets, wingtips, drop tanks, turrets, turtle decks and other odd-shaped parts where formed-plastic sheet is the material of choice.

Like a beginning flier who chooses a four-engine B-17 as his first model, I foolishly took as my initial project an exact-scale cowl at the maximum limits of what the machine could handle. The cowl had a 4x6-inch base and was more than 4 inches deep with some fine detail. In spite of this, I ended up with a perfect part, and in less than half an hour, I turned out four more for some friends.



PHOTOS AND ILLUSTRATIONS BY JEF RASKIN

The mold is placed on the Acc-U-Vac unit; this is then attached to a shop or house vacuum cleaner. I found that the house vac worked well.



The plastic has been sucked down over the mold.

ABOUT VACUUM-FORMING

Vacuum-forming is a simple process; a sheet of rigid plastic is heated uniformly. When the plastic has softened to a rubbery, balloon-like consistency, it's placed over a mold. The air is sucked out of the space between the mold and the plastic, and normal atmospheric pressure almost instantly forces the plastic to conform exactly to the outside of the mold. In a few seconds, the plastic has cooled and hardened into the desired shape. The mold is tugged out and—presto!—the part is ready to be trimmed and painted.

MOLD MAKING

See the scale drawing of the basic cowl shape. The dotted line indicates that I had to make it out of two pieces of wood glued together, because the cowl is nearly 4 inches thick, and I only had 2-inch-thick balsa on hand.

The first step in making a part is making a mold (instructions on making molds are included). If you are copying an existing vacuum-formed part, the easiest way to make a mold might be to plug up the holes in the old part, apply a thin film of petroleum jelly to the interior as a release agent, and then fill the form with plaster.

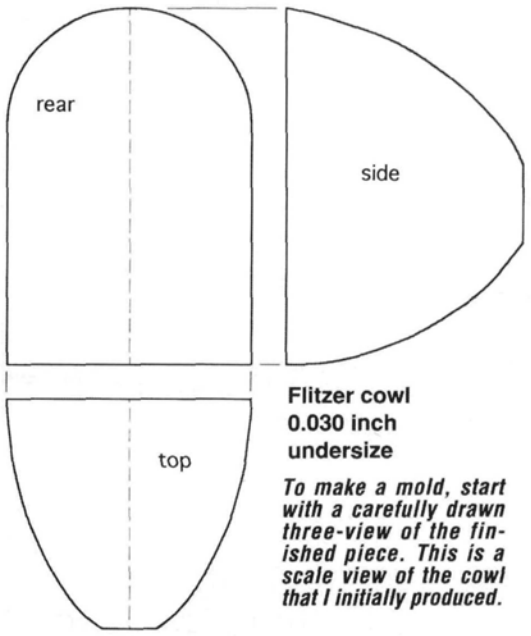
Plaster makes a fine mold. If you can tolerate the slight increase in size, and if the part won't be damaged by the pressure or heat, you can mold right over an existing part. A round part, such as a wheel pant, might have to be cut in half or sunk halfway into a base (modeling clay can work) before it's an effective mold. You may need to use a thin layer of petroleum jelly as a mold release.

The mold for a new part can be made out of wood. For the illustrated cowl, I drew the three-views on my computer and pasted them onto the wood. Then I cut the side view with a scroll saw.

To make the next cut easier, I tack-glued the pieces back together by using a few dabs of white glue and setting them in the microwave oven (1 minute at high). Having a rectangular block again made it easy for me to cut the top view. I pried off the tack-glued parts and used a disk sander to curve the top according to the rear view. More hand and disk sanding achieved the final shape. (I checked with templates as I went along.) The plane being modeled, by the way, is a little-known, but delightful, British biplane—the Z-1 Flitzer designed by Lynn Williams.

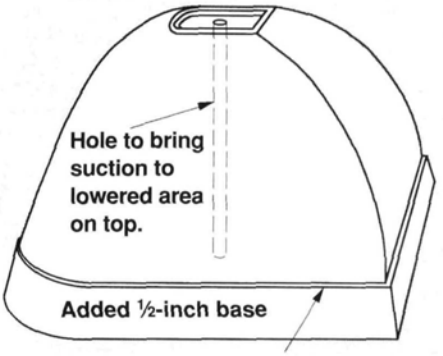
Hard balsa will do if you only need to make a few parts, but basswood or pine is probably better for longer parts runs. When you make the mold, be sure to account for the thickness of the plastic you choose (typically 0.020 to 0.060 inch). The surface finish of the mold has to be pretty good; after sanding down to 400 grit, I used two coats of polyurethane varnish, sanding lightly between coats. (I've been told that dope is just as good as polyurethane.) After the polyurethane had dried, the mold was given a quick sanding, and I polished it with car wax. The wax seems to help release the plastic from the mold.

It can be hard to remove the mold from the plastic part. The plastic has some flexibility, and you can work it around vertical sides or undercut details, but it's best if the mold tapers at least a few degrees, getting smaller toward the top at all times. A shape that doesn't do this may have to be made in more than one piece. The cowl I chose to make

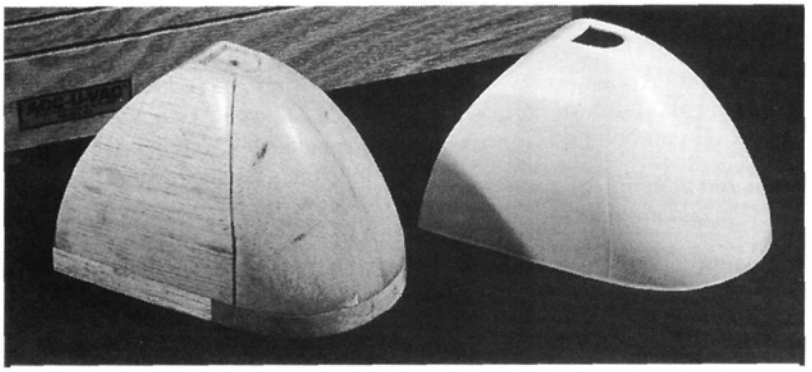


Flitzer cowl
0.030 inch
undersize

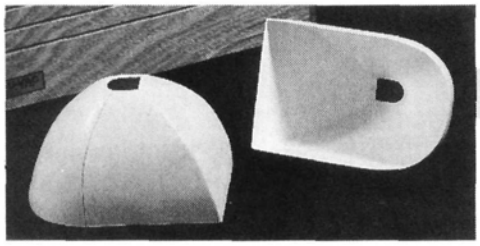
To make a mold, start with a carefully drawn three-view of the finished piece. This is a scale view of the cowl that I initially produced.



This drawing shows a number of important details. First, a ½-inch base has been added to the bottom of the mold so that any webbing will form against the base instead of against the part. The webbing can be easily discarded. A narrow lip or step at the top of the base will leave a fine line on the part to identify where it should be cut away from the scrap plastic. Note that there must be a hole in any deeper indentation or concavity into which the plastic must be sucked.



Here is the mold and the finished cowl (after the propeller opening has been cut out). Note that the fine scale detail has been preserved.



Two views of identical finished cowls.

was a good subject in that it was tapered toward its top (as positioned on the Acc-U-Vac bed). I built a finger grip into the bottom of my mold; this proved very helpful when I removed the mold from the finished part. Inserting a large screw into the bottom (after molding) is another way to provide a finger grip for extracting the mold.

By making an indentation around the area from which the front opening will be cut (as shown), the completed part acquires a stiffening ridge that makes the opening a lot stronger. It's a good idea to add a base of ½ inch height or so on the bottom of the mold; any folds (webs) in the plastic will fall onto this base, i.e., between the bed of the machine and the finished part. I make the base a bit larger than the mold; this leaves a tiny, sharp step on the part that will show you exactly where to separate the part from the scrap plastic.

HEATING THE PLASTIC

In this project, I used high-impact polystyrene in 0.030- and 0.060-inch thicknesses, but PET-G, polycarbonate, cellulose acetate butyrate and other plastics can be vacuum-formed. If I had been making a cowl for an internal-combustion engine rather than for an electric motor, I would have used polycarbonate because it can withstand higher temperatures.

After attaching the chosen plastic to a frame with the supplied clips, the assembly is heated in an ordinary oven that's set to "bake" at an appropriate temperature for the plastic (see the manual for very specific recommendations). To space the clips evenly, I marked their positions on the frame with a permanent felt-tip marker. Using oven mitts (provided!) the frame is put on a special stand (also part of the kit). I had to spread the stand apart a bit to make it fit the frame.

The first time I tried this, I put the assembly into the oven as soon as the temperature reached the point indicated in the manual. This didn't work. I should have followed the instructions and waited 15 minutes for the whole oven to heat. When an oven comes up to temperature, its walls radiate infrared energy from all directions, so it heats the plastic evenly. While it's warming up, convection currents make places over the coils hotter than elsewhere; this will spoil the plastic. So wait a few minutes, as stated in the instructions, before you put the plastic in the oven.

The instructions tell you to mold each kind of plastic when it sags a certain amount. Follow Appian's recommendations. I first thought that letting it sag more would let it follow the mold better. This is dead wrong; the plastic loses its elasticity and doesn't form as well if you let it sag too much.

I wasted a few sheets of plastic simply by not following the instructions. These guys know what they're doing! Listen to them.

PART MAKING

Now we get to the easy and fun part. You hook up an ordinary home or shop vacuum cleaner to the port (mine fit perfectly), and wrap any leaky connections with the masking tape that Appian thoughtfully provides. After waiting until the plastic sags the amount specified in the manual, switch on the vacuum cleaner, use the mitts to lift the plastic out of the oven on its frame, flip it over and press it down over the mold until it contacts the rubber strip. This makes an instant seal and—fwoop!—the plastic snugs down. As Ross Perot says, you can "hear that sucking sound!" As quickly as possible, start operating the built-in second-stage pump to increase the suction. If you have a friend who wants to assist, he or she can pump from the very beginning along with the vacuum cleaner.

CONCLUSION

I later tried to mold some simpler, smaller parts, and they were a cinch. From the moment I opened the box and saw the oven mitts and the finish on the oak box, I thought that Appian Productions' Acc-U-Vac Model 227 would be a winner, and I wasn't disappointed. Except when I goofed (by not following the instructions), it produced perfect parts. This was my first try at vacuum-forming, and the Model 227 made it an easy, satisfying experience. The list price is $169.95; other models and accessories for handling larger and smaller sheets of plastic are available.

**Here's the address of the company that's featured in this article:*
***Appian Productions Inc.,** 145 W. 58th St., New York, NY 10019.* ■

No, not exactly "lo-viz" markings! Jerry Caudle's Maverick Pro shows why he frequently wins craftsmanship and Best of Show awards at places such as Toledo.

5th Annual Sup

Sponsored by Model Airplane and JR Remote Control

by RICH URAVITCH

Spectators examine the model jets and ask the builders questions. Many were amazed at the detail and quality of the workmanship.

The winners with the local hero in the background. Yes, Virginia, there is a Metropolis, and Superman does live there!

JUST what is "faster than a speeding bullet, more powerful than a locomotive and able to leap tall buildings in a single bound"? If you guessed Superman, you'd be historically correct, but contemporary answers might be: the Ultra Viper from Bob Violett Models (BVM*), the awesome SWB* jet-turbine engine and Jerry Caudle, the Superman Fan Fly contest director (well, maybe not *really* tall buildings!).

Getting to the fifth edition of this all-jet meet brought out the Lewis and Clark in me. I flew into Paducah, KY, and drove a car across the river to the home of Superman. You instantly realize where you are as huge statues of the Marvel Comics superhero pop out frequently, along with, for this weekend anyway, "Welcome Jet Pilots" banners that stretched across the main thoroughfares. Metropolis obviously recognized that we have our own selection of superheroes and that many of them would be on hand for the fan fly.

rman Fan Fly

vs

The Top Gun MiG-29 Fulcrum proved itself to be an able performer. This example entered by Jim Brun lacked only a pilot bust to complete the illusion of realism.

The Best Scale Finish award went to Herve Serrano for his T-33 shown here on final with gear down, partial flap and speed brakes deployed. Shouldn't the backseater be looking at the camera?!

Ace finisher and event CD Jerry Caudle used a combination of paint and "chrome" films to produce a highly polished finish on his BVM T-33.

Charlie Trivets loves big twins. This is his Yellow Aircraft F-14A Tomcat. His pearlescent-finished JMP F-4 had an altercation with a runway obstruction on landing, and the left-hand inlet was peeled away.*

Scale modelers always seem to come up with color schemes that are unusual, attractive and authentic. This one duplicates an F-16 that's based at the Air Force Flight Test Center at Edwards AFB. It's much more attractive (and visible) than the usual two-tone gray.

SUPER SITE

Although we've now proved that many of today's ducted-fan models can easily operate off grass fields, this wasn't necessary, as Metropolis Airport was chosen for the gathering. It's home to a small number of General Aviation aircraft and, at least for *this* weekend, a whole bunch of jet models. The 4,000-foot runway provided a nearly obstruction-free launch-and-recovery surface for some of the most beautiful fan-powered airplanes anywhere.

How does one secure such an ideal environment for the weekend? In addition to being an ace modeler and a skilled CD, Jerry also has a small hobby shop at the airport, where he paints full-scale airplanes for a living. Oh, did I

PHOTOS BY RICH URAVITCH

Mike Lesher has every reason to smile; the first flight of his brand-new Ziroli F9F-2 Panther went off flawlessly. Another entry into the big-jet field.

"Whooshful Thinking !"

Jeff Seymour is flanked by his "Team Turbine" crew: Scott Stenerson and Dennis Horney. These guys made it happen!

The most powerful model turbine jet yet!

Many of you, having followed the progress of R/C ducted-fan models over the past 10 or so years, may have concluded that all that was missing, all that was needed to complete the illusion, was the sound! No one could deny that the performance was there; fan-powered, well-engineered models are exceeding 200mph almost routinely these days. Engines work, fans propel and airframes stay together throughout their speed/maneuver envelope. Although the shrill, piercing scream of a healthy .91 turning a 5-inch rotor in excess of 20,000rpm is unmistakable and attention-getting, it simply isn't jet-like.

Falling squarely into the "wouldn't it be neat" category is a model-size, operating turbine engine that we could install in our jets and go whooshing around the field with! It's not too far-fetched an idea either, because less than 20 years ago, we were trying to figure out how to fly a model F-4 without a prop in its nose! Then along came Bob Violett, Jim Scozzafava and a Phantom-like design called the Sundowner, and the rest, as they say, is history!

A similar R/C revolution seems to be occurring now; one of the key players is Jeff Seymour. Jeff heads a small company in Wisconsin called SWB Turbines. He's an accomplished R/C heli flier as well as a first-class machinist, so his involvement with complicated, technical "things in motion" is understandable. Does he have a background in turbine propulsion systems? Nah, but he figured that he could learn that end of it and, when he had, he was confident that he could build it! So, after taking what he refers to as a "few" courses in jet-engine technology and related subjects at Purdue, he decided that it was time to make something. That was eight years and four or five engines ago.

The simple, tidy installation of Jeff Seymour's turbine engine is in a Yellow Aircraft F/A-18 Hornet.

Over the last year and a half, he focused on a project to develop a small-diameter (5.3-inch) jet turbine (incidentally, this is about the same diameter as the Dynamax/Turbax/Ramtec series of fan units), intending to install it in an airframe and fly it. This is important to remember, as other turbines have been developed but have only been run in a test cell or "on the bench." Jeff wanted his turbine to operate on kerosene—the basic ingredient in full-size-jet fuel—rather than the liquid propane that's used by most other jet engines.

Was he successful? If what we witnessed at the '93 Superman Fan Fly was any indication, he was—beyond any doubt! Jeff installed his newly developed, 11-pound engine in a slightly modified Yellow Aircraft* F/A-18 Hornet and brought it to Illinois with nine flights on it. "Hot-Stick" Bob Fiorenze, who had performed the early test flights in Florida, was "imported" to the Fan Fly for the occasion. The Hornet carries about 7 pounds of fuel (3.75 quarts) and weighs 40 pounds at takeoff. After lubing the engine with oil, Jeff and his crew fired it up using a ground power unit to supply starting air to the engine. It whined, rumbled with the introduction of ignition and settled into a low whistle at idle.

Anyone who hadn't been aware of what was going on by now sure tuned in quickly as Bob taxied the big bird to the end of the active, set the brakes and spooled up the engine. On brake release, the Hornet, propelled by 34.6 pounds of thrust, accelerated briskly, rotated after a roll of about 150 feet and climbed at what appeared to be a 30-degree angle as the gear came up and Bob initiated a right-hand turn. The airplane trimmed up quickly, and a number of high-speed passes were made to demonstrate its performance. I estimate the speed to be easily in excess of 160mph, but that was only *part* of the impression factor; the other was the noise, or lack of noise, coming from the big, red Hornet. The *piece de resistance*, however, came when Bob set up for landing. Throttling back on the downwind leg, Bob extended the gear, turned base while further reducing power and turned onto final with the engine audibly winding down. As it touched down and rolled out past the spectators, there was absolute silence until everyone was sure that the "mission" was over; then all you could hear were cheers, whistles and applause.

What Jeff has accomplished with this turbine is nothing short of remarkable; he has designed, fabricated and successfully operated a unit that turns 120,000rpm and is capable of (with modification) producing 47 pounds of thrust. Plans for the manufacture and distribution of the engine are in the works, and it could all be accelerated if a large customer, such as the Air Force, came along and placed an order to launch SWB into the production business. As for its application to the hobby market, Jeff recognizes that he'll have to downsize the engine to simplify installation in smaller airframes, and/or de-rate the existing output to comply with the proposed AMA thrust limit of 25 pounds.

Neither of these seems to be a big problem in light of what he has thus far accomplished. Although most of us jet-fan pilots are satisfied to wish, Jeff Seymour prefers to whoosh...and he's got the engine to prove it!

mention that he's also the airport's FBO (fixed-base operator)? Now you understand how the site was secured!

So, we now have the site and the skilled contest management; it must be time for a word from our sponsors! Picking up at least a piece of the tab for this fan-filled weekend were the combined forces of *Model Airplane News* and JR Remote Control*. Without much fanfare, they saw to it that prizes and other goodies were available for presentation to the participants. It sure made an impression on the recipients!

I arrived on the day before the event's official first day (October 1), expecting to use the time to look around, get settled in and await the arrival of all the participants Jerry had told me to expect. I guess everyone had a similar idea, because the pit area was already half full, and test hops were under way on the flight line.

Norm Meeks readies his Byron BD-5J on this very active flight line.

SUPER MIX

An overwhelming majority of entries were kits, with Vipers and Aggressors leading the list of sport-jet favorites. The scale-jet world was covered by F-16s, F/A-16s, T-33s, F-4s, F-86s, A-6s and F-14s. Appealing to the scratch-building community were the outstanding efforts of Mike Kulczyk with his F-84G Thunderjet and the little BD-10 that was designed and built by longtime fan enthusiast Paul Appelbaum*. This little rocket ship appeared to be as fast as nearly anything there, and Paul could always be found answering the questions of would-be customers. Paul works in the fiberglass shop of the facility that produces the full-size BD, so I guess he can be counted on to know both the airplane *and* his business!

The Friday evening mixer, featuring free pizza, beverages and "hangar talk" (which, incidentally, was where it was held), contributed to the laid-back, informal atmosphere. If you couldn't get your questions answered here or benefit from firsthand "product reviews," you probably couldn't anywhere! A full range of discussions with all the "names" in the jet world—guys such as Bob Fiorenze, Tom Cook, Bob Violett, Terry Nitsch, Billy Harris and Carl Spurlock—offered useful information to both novices and experts.

During the rest of the weekend, the pits, the airport ramp and the taxiway was filled with jet models or cars, or both. As I walked through the pit area, I discovered a number of models that I hadn't seen before. Robert Cahill's A-10A wore an experimental (and short-lived) tan-and-sand camo scheme borrowed from a Barksdale AFB-based T-Bolt II. Bob was plagued with engine problems throughout the weekend and just couldn't seem to get them both running well enough to attempt a flight. Pity, too, as a lot of us were waiting to see it fly.

Faring much better in the engine-run department was Mike Lesher with his Ramtec*-driven F9F-2 Panther built from Nick Ziroli* plans with a Leading Edge Models* fiberglass fuselage. Weighing in at 16½ pounds, Mike's Grumman Cat is a great flier and a legal giant scaler. A later addition to Grumman's fighter/attack stable came in model form in Eric Mey's* beautiful A-6 Intruder. This single-engine model uses a bifurcated tailpipe and looked quite realistic as it zipped across the southern Illinois real estate. The nose-gear problems that kept cropping up eventually resulted in damage to the airframe that Eric, wisely, I think, decided to repair at home.

A quick tally of the models on hand disclosed that the BVM offerings had a decided numerical advantage. The Maverick jet trainer was well-represented with no less than 15 models registered. This sport jet lends itself extremely well to "trick" paint schemes, as evidenced by Lynn Elsner and Jerry Caudle's entries. It also makes a convincing "scale-type" jet when it's finished in the pseudo-military livery that Bob Violett has on his personal, Navy-marked machine. I watched most of them fly; they all appeared to perform quite smoothly. They weren't as fast as their high-performance brethren, such as the Vipers and Aggressors, but they were certainly brisk enough for most jet modelers.

Another kit that made its presence known was the F-15 from Top Gun Aircraft*. They could frequently be seen buzzing around the sky, powered by single fan units and displaying some remarkable

Lynn Elsner brought his new BVM Maverick, which has a pretty metallic purple and gold trim, all the way from Nebraska. Sport jets frequently win Best Finish awards; this Mav is typical.

Rocketing its way across the Illinois terrain at low level is the T-38 built by Carl Spurlock from a Byron* F-20 kit. Carl has had this airplane for a while; he knows its capabilities and flies it very well.

Terry Nitsch's BVM F-86 "over the numbers." Terry placed second at Top Gun '93 with it.

slow-flight qualities. Along similar lines (and my favorite of Top Gun's two offerings), the MiG-29 Fulcrum shares the same design philosophy as the Eagle: single engine, medium size, and good, solid flying capability.

If there was ever any doubt that miniature jet-turbine engines would be an R/C reality, it was dispelled over the course of the weekend. Not one, but two jet engines were demonstrated where it counts: in the air! The larger one was Jeff Seymour's kerosene burner (see sidebar). The other was the French-made JPX* T-240 unit that Kent Nogy installed in a modified BVM Viper (appropriately called the Turbine Viper); he wowed the spectators with its nearly silent, but commanding, performance. The impressive little engine is only 4.5 inches in diameter and 13.1 inches long. It runs on liquid propane and produces almost 9 pounds of thrust at 120,000rpm. Although Kent made it look easy, I suggest that you don't run right out and try to install one in your own Viper, or any other ducted-fan-powered airframe for that matter. It simply isn't that easy, and it's *not* a "bolt-in swap" (in hot-rodder's parlance). After the smoke has cleared, I'm certain that we'll find properly engineered airframes—perhaps some conversions to existing kits—into which you can stuff your new investment. In the meantime, if you think that a turbine may be in your future, read up on the principles of operation, become familiar with the safety aspects and know what you're getting into. High-revving turbines aren't nearly as "operator tolerant" as that sport .40 you've got mounted on the front of your favorite Sunday flier!

Here's a closeup of the flaps and wing section of Tom Cook's JMP T-33. Nearly everything is made of molded fiberglass. The dark areas are carbon-fiber reinforcements. To reduce building time, the JMP T-33 features high levels of prefabrication. With a wingspan of 88 inches, it's the largest presently available T-Bird. A Dynamax fan and O.S. .91 power it.*

When Sunday afternoon came around, the special awards were presented and there was a bunch of handshakes and goodbyes. Many new friends had been made, along with a lot of converts to the world of R/C ducted-fan enthusiasts. I left reluctantly, with the feeling that it would be a long time until the first weekend in October came around again. This event is a "must attend" for jet modelers; its central location makes it accessible to a lot of R/C'ers, and it's a comfortable time of year in that part of the country. It was extremely well-run, the hospitality was outstanding, and the camaraderie was evident. How did it all happen? I'm not sure, but as I was driving away, I saw a blue blur with a red cape duck into a phone booth. As I turned the corner, I looked back; that sure looked like Jerry Caudle straightening his glasses as he exited the booth. Bye, Metropolis, till next year!

Paul McCauley completed this JMP T-33 in four and a half weeks. Paul credits the high level of prefabrication of the fiberglass kit. It's a great flier.

This A-6 Intruder, built by Eric Meys and powered by a single O.S. .91, was plagued with landing gear problems. When it was airborne, it flew convincingly.*

**Here are the addresses of the companies that are mentioned in this article:*

***Bob Violett Models (BVM),** 170 State Rd. 419, Winter Springs, FL 32708.*
***SWB Turbines,** 1120 Meadowview Dr., Manasha, WI 54952.*
***JR Remote Control (Horizon Hobby Distributors),** 4105 Fieldstone Rd., Champaign, IL 61821.*
***Paul Appelbaum,** 2232 Riverwood Trails Dr., Florissant, MO 63031.*
***Ramtec Fans,** distributed by Aeroloft Designs, 2940 W. Gregg Dr., Chandler, AZ 85224.*
***Nick Ziroli Models,** 29 Edgar Dr., Smithtown, NY 11787.*
***Leading Edge Models,** 170 Oval Dr., Central Islip, NY 11722.*
***Mey's Hi Tech Hobby Inc.,** P.O. Box 452, Stormville, NY 12582.*
***Top Gun Aircraft,** 418 W. Jefferson St., Ottawa, IL 61350.*
***JPX Turbines,** distributed by BVM (see address above.)*
***Yellow Aircraft,** 203 Massachusetts Ave., Lexington, MA 02173.*
***Jet Model Poducts (JMP),** 211 N. Mullen Rd., Belton, MO 64012.*
***Byron Originals,** P.O. Box 279 Ida Grove, IA 51445.*
***O.S./Great Planes Model Distributors,** P.O. Box 9021, Champaign, IL 61826.*
***Dynamax,** distributed by JMP (see address above).* ■

SPECIAL AWARDS

• Speed Merchants • Joe Rapalowski • Chris Huhn • Dave Ribbe • Roger Shipley • Terry Nitsch

Award	Pilot	Plane
Best Scale Finish	Herve Serrano	T-33
Best Sport Finish	Kent Landefeld	Maverick
Best Twin Performance	Tom Cook	F-4
Best Sport Performance	Terry Nitsch	Ultra Viper
Best Scale Performance	Tom Dodgen	F-86
Best Scale Performance	Gus Hudson	F-86
Best of Show	Kent Nogy	Turbine Viper

AEROBATICS MADE EASY

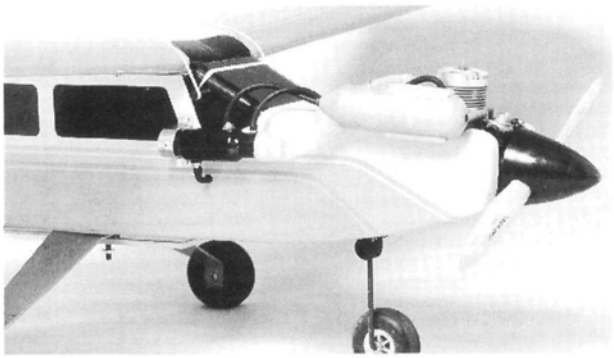
DAVE PATRICK

SMOKE 'EM WITH 2-STROKES!

THIS MONTH, we are going to continue our three-part how-to series on smoke. In case you missed last month's column, we covered smoke theory, hints and how to get great smoke from your 1.20 4-stroke. In this part, we will focus on getting your smaller, 2-stroke (.40 to .60) engine to smoke. Next time, we'll move to the big, chain-saw types.

THE CHALLENGE

Probably, the most difficult type of engine to get to smoke well is the smaller 2-stroke running on glow fuel. With a small glow engine, you simply don't have the luxury of the tremendous heat generated by larger engines. Moreover, glow engines run cooler than gas engines, so the "how"—the technique used—is very critical to getting good smoke! Luckily for us, a gentleman named Randy Dewberry spent two years researching, developing and perfecting techniques for generating excellent smoke from these smaller engines. He now markets a complete system under the name Smoke Master, distributed by American Model Products*. Considering the inherent challenges in producing a smoke system for small 2-strokes, it works very well. This system is totally integrated, i.e., there are no additional valves, pumps, etc., to obtain, and it is fairly simple to set up.



The Carl Goldberg Models Vector carries the Smoke Master system linked to an O.S. .40.

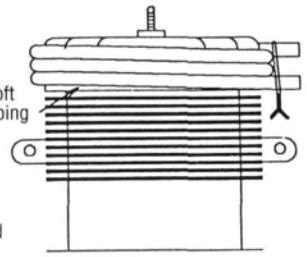
The basic concept of the Smoke Master is as follows. The exhaust pulse is captured with a check valve and is directed to a pressure-control valve and then to the smoke tank, which, in turn, provides the smoke fluid under pressure. From here, the fluid goes to the preheater and then to the controlling valve. When this valve is opened, preheated smoke fluid that is under pressure enters the muffler and, voilà—great smoke. The key to the Smoke Master system's success is the designer's attention to details—the correct pressures, proper preheating, etc.

Note that when you're adding smoke to an aircraft that flies on a .40 engine or one of a similar size, space may be an issue. Plan carefully where you will put the smoke tank and related gear. For example, I have used the Smoke Master quite successfully in a Carl Goldberg Models* Tiger 2 powered by an Enya* .40. By placing the smoke-oil tank in the canopy, I had plenty of room, and the system worked very well.

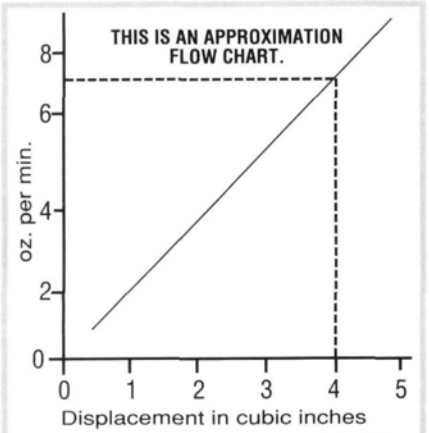
Randy points out that, for some reason, some engines just don't put out the smoke that others of similar displacement do. An example: the inexpensive K&B* .65 puts out smoke better than most engines of similar size. Go figure! Randy thinks that engines' exhaust temperatures differ, owing, probably, to timing and other aspects of their design.

You can also get great smoke from your smaller 2-stroke by using a Simple Smoke made by Tejera Microsystems Engineering*. This more generic system can be used on a wide range of engines. The excellent instructions include many hints and explanations to give the user a full understanding of what's going on. Another system, the Super Smoke Valve (catalogue no. 255), is made by Du-Bro*. This very simple unit uses crankcase pressure and can be quite effective; but the instructions could offer a little more information, and you will need to drill and tap your crankcase. However, the price is right; it's the least expensive

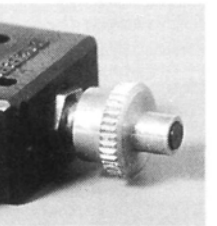
FIGURE 1



ILLUSTRATIONS BY TEJERA MICROSYSTEMS



How large should your smoke-fluid tank be? Use this chart to find the flow needed and then multiply that figure by the number of minutes of smoke that you want. For me, 3 to 5 minutes is plenty. Example: 4 cubic inches equals 7 ounces per minute; hence, 3 minutes of smoke would require a 21-ounce tank, and 5 minutes, a 35-ounce tank. I would use a 24- to 32-ounce tank.



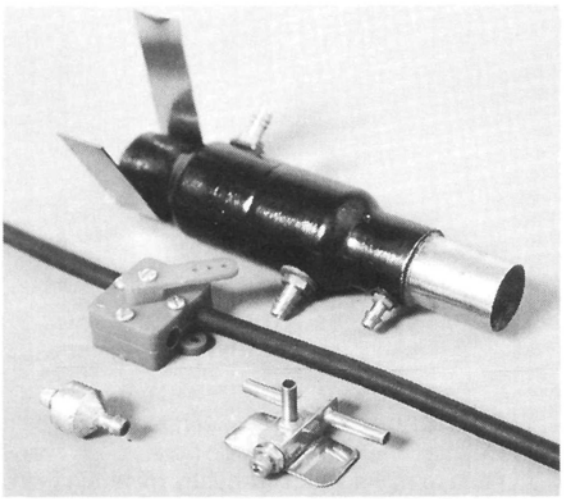
The Varsane remote needle valve.

system that I am aware of. Whichever system you decide to go with, I strongly recommend preheating.

PREHEAT

Preheating can mean the difference between success and failure, and at the very least, it will almost always give you better smoke! I recommend that you *always* preheat the smoke oil if at all possible. At the last TOC, I did not preheat, yet I obtained great smoke because of the tremendous heat generated by my 4.2 Infinity* engine, which was running on glow. I can't imagine how much smoke I could have produced if I had preheated the smoke oil! Again, preheating the oil can be especially important on the smaller, 2-stroke, in which that kind of heat just isn't available.

Some after-market mufflers can be purchased with preheaters as an option.



PHOTOS BY DAVE PATRICK

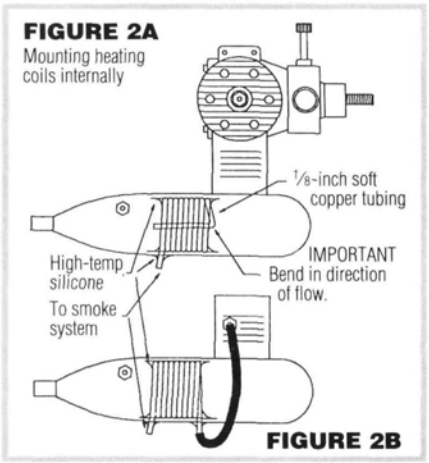
The Smoke Master smoke system from American Model Products.

Slimline* offers such mufflers, and they work very well. If you already have a muffler without preheat, all is not lost; there are other ways you can add this feature to a current setup. Let's look at a few.

HEAD COILS

You can make a simple head coil by wrapping some soft, 1/8-inch-diameter copper tubing around the non-finned portion of your engine head. The smoke-oil source will be piped to one side of the coil. The opposite side of the coil is attached to a length of tubing that, in turn, goes to the tap on your muffler. Make sure that the copper tubing is tightly coiled around the engine head. You can use some steel wire or automotive hose clamps to hold the tubing firmly against the head (see Figure 1). Try to find extra-soft copper tubing for this application. *Caution: do not cover the air-cooling fins on the engine.* Note also that even though the smoke fluid will cool the engine a bit while it flows through the tubing, it won't cool your engine at all when the flow stops.

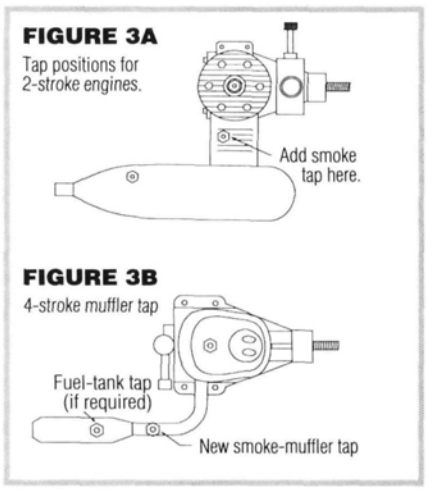
When testing the effectiveness of this system, you may notice that the smoke is very dense when the system is initially turned on but thins out after a few seconds. This means that either you don't have enough mass in your preheating system (in the form of coil length), or the thermal coupling to the engine is poor. This is easy enough to fix.



MUFFLER COILS

If your muffler is big enough and you want to make your own muffler coils that fit inside it, you can experiment by forming 1/8-inch-diameter soft copper tubing around a wooden dowel. Just make sure that the dowel's diameter is 1/4 inch less than the available inside diameter of your muffler. Drill a hole in the back half of the muffler for one end of the coil. The other end of the coil should sit as close to the engine head as possible. Red Hi-Temp silicone should be used to steady the coil in the muffler (see Figures 2A and 2B).

Make sure that the exit point for the smoke fluid is either at 90 degrees to or pointing more or less in the same direction as the exhaust gas flow (see Figure 2A). Otherwise, the blast from the exhaust may work against the flow! You



may also route the tubing so that it comes back out of the muffler and re-enters the exhaust at the header (see Figure 2B). A small piece of neoprene tubing can be used to connect the copper tubing from this point to the muffler tap at the header.

AFTER-MUFFLER COILS

Finally, another good way to preheat oil is to route it through a preheater that is attached to the exhaust of your existing muffler. Use silicone or neoprene tubing and plastic ties or automotive clamps to secure the preheater to your muffler, in the same way as you would hook up a tuned pipe (see Figure 4).

You can easily construct a preheater.

Cut a 3- to 4-inch piece of ½-inch-diameter brass tubing, and coil soft, ⅛-inch-diameter copper tubing around it. Either silver-solder the tubing together, or use an automotive hose clamp to ensure good contact and maximum thermal transfer. Using short lengths of silicone or neoprene tubing, connect the large brass tubing to the exhaust hole of your muffler. This is like attaching a tuned pipe to a header. Connect the tubing from your smoke system to this preheater coil. The smoke oil should now be hot enough to run directly to your muffler tap.

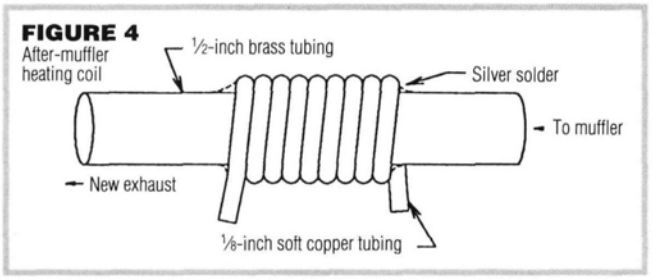


FIGURE 4

If you don't want to go through the hassle of building your own after-muffler preheater, you may want to purchase one from American Model Products. They will sell you the preheater from their smoke system separately. It is attached in much the same fashion as the one we described above.

FLOW

Like setting the needle valve on your engine, getting the correct flow rate of the smoke fluid is another important ingredient in getting maximum smoke. If the flow rate is too low, you simply will not get the maximum smoke, and if it is too high, you will waste smoke fluid and, possibly, reduce the maximum smoke output. This takes some experimentation. Start lean, and increase the flow until you notice lots of smoke oil downwind of the aircraft and, possibly, a reduction of smoke output. To start, I like to set the flow rate of the smoke oil so that it is approximately the same as the fuel consumption rate of the particular engine (at full power) that I am using.

A really neat way to adjust flow rate is to use a remote needle valve, such as the Varsane* (see photo, opening page). Of course, to use this, you must have excess capacity to begin with, as the valve can only reduce flow. Place the valve in the line right before the line enters the smoke muffler. Having only the needle valve showing keeps the installation neat and makes the valve easy to get to. To measure the actual flow rate, get your system fully up and running, turn on the smoke valve, and let the smoke fluid flow into a measured cup for a certain period. I like to use one minute. The simple chart I have provided is only a guide; your particular setup and flow-rate needs may vary, depending on your engine setup.

Look at my last article in the March '94 issue for recommended commercially available smoke fluids. Well, that about covers it for getting smoke from a small engine. Next month, we'll cover getting great smoke from a big, gas-guzzling, giant-scale engine. Until then!

You may be interested in a smoke-systems tape called "Smoke On." For information, contact Gulf Stream Air Video Inc., P.O. Box 482, Hagan, GA 30429; (800) 531-1784.

**Here are the addresses of the companies mentioned in this article:*

***American Model Products Inc.,** Rt. 3, P.O. Box 57, Baxley GA 31513; (912) 367-0567.*

***Carl Goldberg Models,** 4734 W. Chicago Ave., Chicago, IL 60651.*

***Enya;** distributed by Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391.*

***K&B Mfg. Co.,** 2100 College Dr., Lake Havasu City, AZ 86403.*

***Tejera Microsystems Engineering Inc.,** P.O. Box 340608, Tampa, FL 33694.*

***Du-Bro Products,** 480 Bonner Rd., Wauconda, IL 60084.*

***Infinity;** distributed by Gulf Stream Air Video Inc., P.O. Box 482, Hagan, GA 30429.*

***Slimline Mfg.,** P.O. Box 3295, Scottsdale, AZ 85257.*

***Varsane Products,** 546 S. Pacific St., Ste. C-101, San Marcos, CA 92069.* ■

ENGINE REVIEW

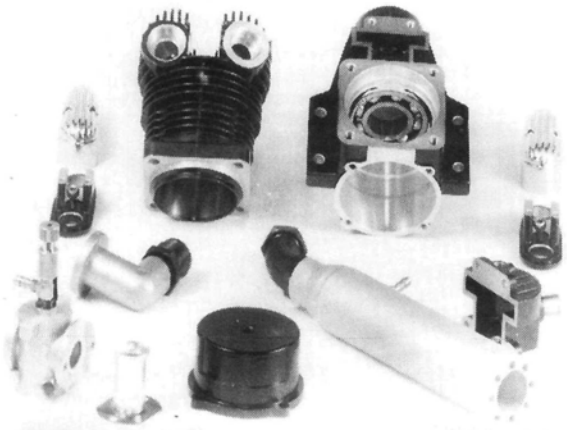
S A I T O

FA-150S AAC

You want torque?!

by MIKE BILLINTON

SAITO'S* NEW 25cc engine is the largest, mass-produced, *single*-cylinder, 4-stroke sports engine available, and it continues the expansion of their exclusive 4-stroke line.



The core of the new 1.50S is the high-tech cylinder/head block (upper left). It features separate valve seats and guides.

It's essentially a bored and stroked version of their existing 1.20ci engine (6 percent bore increase and 11 percent stroke increase), and so ends up with one of the lowest stroke/bore ratios around at 0.813:1.

Such short strokes are not necessarily only synonymous with high rpm. In fact, when applied to the OHV 4-stroke engine, the resulting larger cylinder bore obviously allows bigger inlet valves to be incorporated and therefore it has better breathing and more power at any rpm point.

In common with other Saito 4-strokes, the 1.50S continues with the highly demanding (in terms of manufacture), one-piece head/cylinder block. No through-bolts or head seal are necessary, and Saito engineers continue to revel in the design freedom this allows!

Anyone who disassembles a small 4-stroke may observe the restrictions that are placed on the valve and the port layout where head bolts have to be taken into account. That Saito is prepared to put up with the "down" side of that big decision to eliminate those bolts altogether is a measure of the seriousness with which they view this problem.

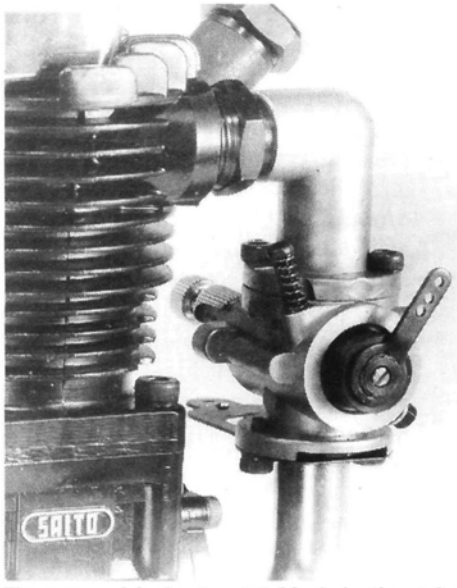
As a result, even operating solely from the bottom end of the cylinder/head block, Saito successfully achieves the following features:

- correct combustion-chamber shape;
- bored valve throats and stem guides;
- inserted, finished valve seats;
- inserted, ground liner (ground, chromed inside surface of aluminum casting in this 1.50S and other AAC engines in the range);
- correct piston/head/valve clearances.

The more normal use of a separate cylinder head makes virtually all these tasks considerably easier to achieve, so clearly the engineers at Saito feel that they gain much from putting themselves "on the rack" in this way. Full-size 4-stroke engines that use this procedure are few indeed, and these are only in the racing arena.

A table showing the various 4-strokes tested over recent years gives relative performance figures for torque per cubic inch. Note that the O.S. FS-120SP Roots supercharged engine and the "crankcase-charged" YS F-120SF both, of course, head the list, which otherwise comprises naturally aspirated engines.

The list in the chart is by no means exhaustive, and in some respects it could be more up-to-date, but it seems to suggest that Saito



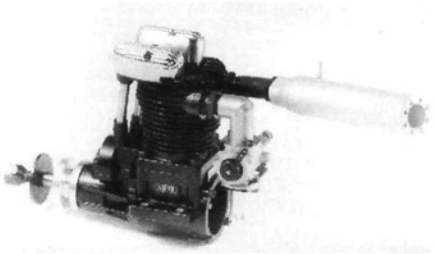
The screwed locknut, rotatable induction tube and solid carburetor are all in keeping with high quality of the rest of the 1.50S.

does recoup something for all that extra work.

Of more direct interest in this report is the low, low rpm figure at which maximum torque occurs for the Saito 1.50S; the direct link with noise problems at flying sites is made here quite forcibly. Although Saito's propeller recommendations (around 15x8) place engine rpm near to maximum horsepower at 9,000 plus, tests here showed a considerable capability to operate without distress down to surprisingly low rpm with really heavy loads. The area between 6,000 and 8,000rpm, however, probably offers the best compromise between power production and noise level if the standard silencer that's provided is used.

MECHANICAL POINTS

There's a variety of interesting detail in the 1.50S, but by far, the central pièce de résistance is the superb cylinder block. The use of steel for the valve seats is an unusual departure for a model 4-stroke, and unlike the majority of competitors' engines, the Saito 1.50S uses the normal full-size-engine method of separate seats and valve guides; this allows greater design freedom in port throughways, as does the lack of through-



The new 1.50S has an eye-catching, smart black finish and a thoroughbred style of performance to match.

bolts mentioned earlier. The inlet and exhaust-valve-head diameter of 14mm allows a throat bore (behind the valve head) of nearly ½ inch; the resulting compression ratio from the hemi-head combustion-chamber shape is a fairly high 9.9:1. This indicates that the Saito head configuration is a good one for keeping detonation at bay.

The bore finish of the internally chromed aluminum cylinder (AAC) is exemplary, so that the use of a single unpinned, cast-iron piston ring on a high-duty aluminum-alloy piston (having a significant 0.002-inch skirt and 0.005-inch crown clearances) still results in a very firm compression, even when the engine is cold.

The piston itself is a really solid structure with good support for the wristpin. Teflon

PHOTOS BY MIKE BILLINTON

The 5-ounce crankshaft has a heavy, counterweighted web to balance the heavy-duty rod and piston. The prop nut is both split and tapered to match the cone recess in the washer. It didn't loosen during the test (unlike what often happens with single-cylinder 4-strokes).

end-pads are used to position the pin.

To cope with the large single-cylinder torque pulses, the high-duty, aluminum-alloy connecting rod is a well-designed H-beam style, though surprisingly, it isn't provided with bronze bushings at either the little or the big end. Given the well-known relative lack of bottom-end lubrication in the average model 4-stroke engine, this might appear to be an omission of some importance. In practice, and following the lengthy test session, there was no noticeable wear resulting from this particular point.

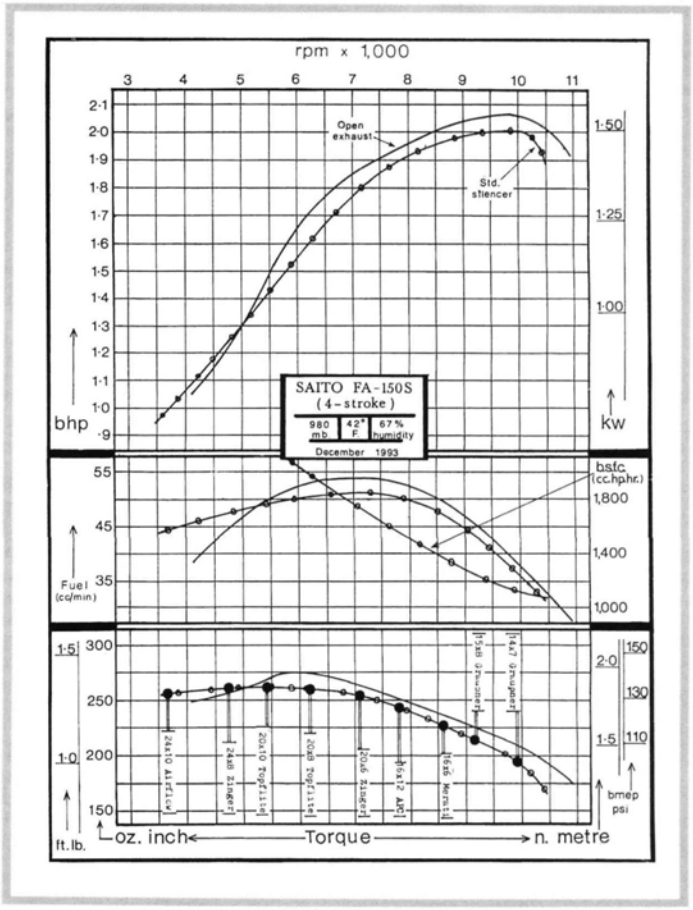
Both the inlet and the exhaust cams are locked together on the single half-time cam wheel, with the inlet having a long dwell shape that results in a very generous total opening period of 301 degrees. Evidence of the high inertia possessed by the incoming inlet gas stream is the fact that here, the inlet valve doesn't finally close until the piston is halfway up the final compression stroke!

Hollow steel pushrods are fitted with hardened-steel endcaps, and they operate hardened-steel rockers at a lift ratio of 1.3:1, i.e., the valve lifts a greater amount than the cam.

The bottom-end crank-case housing is a meaningful 15 ounces with shaft and cam case fitted, and it's a well-designed structure to support that fine upper cylinder block. A long, steel, tapered collet fits into the propeller driver, and a highly efficient tapered and split prop nut is in the tapered recess in the thick prop washer. These two items proved infallibly secure in coping with those very high single-cylinder power pulses that often prove so troublesome in our model 4-stroke engines.

The front main bearing is equipped with a rubber seal, and the lower crankcase breathes by means of a nipple in backplate.

The carburetor is a standard, twin-needle, rotating barrel-throttle style. The main fuel needle is precise and operates within a very small O-ring to ensure that no air leaks occur



SPECIFICATIONS

WEIGHTS & DIMENSIONS

Capacity	1.53718ci (25.180cc)
Bore	1.340 in. (34.036mm)
Stroke	1.090 in. (27.68mm)
Stroke/bore ratio	0.813:1
Timing periods	Inlet opens—37° BTDC
	Inlet closes—84° ABDC (total 301°)
	Exhaust opens—68° BBDC
	Exhaust closes—37° ATDC (total 285°)
	Overlap—74°
Combustion volume	2.83cc
Compression ratio	Geometric 9.90:1
Carburetor bore	0.391 in. (9.94mm)
Major crankcase diameter	0.6685 in. (16.99mm)
Minor crankcase diameter	0.393 in. (9.99mm)
Crankpin diameter	0.3145 in. (7.99mm)
Crankshaft nose thread	0.313 in. x 20 TPI (8x1.25mm pitch)
Wristpin diameter	0.275 in. (7.01mm)
Connecting-rod centers	1.69 in. (43mm)
Engine height	5.3 in. (135mm)
Width	2.72 in. (69mm)
Length	
—Prop/backplate	4.26 in. (108.2mm)
—Prop/carb. rear	5.6 in. (142mm)
Width between bearers	1.79 in. (45.5mm)
Mounting-hole dimensions	2.32x0.945x0.165 in. (59x24x4.2mm holes)
Frontal area	8.9 sq. in.
Weight	Bare—30.4 oz. (864g)
	—with standard silencer—32.9 oz. (932g)
Crankshaft weight	5.2 oz. (148g)
Piston weight	0.70 oz. (20g)
Connecting-rod weight	0.30 oz. (8g)

PERFORMANCE

Max. b.hp	2.06 @ 9,820rpm (open exhaust/10% nitro)
	2.01 @ 10,175rpm (standard silencer/10% nitro)
Max. torque	275 oz.-in. @ 5,898rpm (open exhaust)
	260 oz.-in. @ 4,993rpm (standard silencer)

PROPELLER RPM	Open Exhaust	Standard silencer
24x10 Airflow	—	3,643
22x8 Mastro	—	4,690
24x8 Zinger	—	4,748
20x10 Top Flite	5,465	5,433
20x8 Top Flite	6,335	6,224
18x7 Mastro	—	6,740
18x8 Top Flite	—	7,059
20x6 Zinger	7,156	7,103
16x12 APC	7,783	7,721
14x14 APC	8,074	8,020
16x6 Merati	—	8,664
15x8 Graupner	9,270	9,120
15x8 APC	9,387	9,270
16x5 Zinger	9,571	9,427
13x10.5 MK (glass)	9,730	9,544
14x7 Graupner	10,093	9,920
14x8 APC	10,307	10,072
13x6 Top Flite	—	10,995

PERFORMANCE EQUIVALENTS

b.hp/ci	1.34	1.31
b.hp/cc	0.082	0.080
b.hp/lb.	1.08	0.98
b.hp/kilo	2.38	2.16
oz.-in./ci	178.90	169.10
oz.-in./cc	10.90	10.32
oz.-in./lb.	144.70	126.40
Newton meter/cc	0.078	0.074
b.hp/sq. in. frontal area	0.23	0.22

TORQUE PERFORMANCE

Engine	Comparative Torque (oz.-in./cu.in.)	Actual Torque (oz.-in.)	Rpm point for max torque
O.S. FS-120SP	243	291.6	8,333
Saito FA-150S	169	253.5	4,993
YS F-120SF	196	235	6,200
Enya R120	165	198	7,900
Saito FA-80	175	140	6,416
Laser 90	155	139.5	5,200
Saito FA-65	182	118	7,530
O.S. FS40 Surpass	131	52.4	8,800

Manufacturer: Saito Seisakusho Ltd., 22-7 Tokagi, 3-Chome, Ichikawa-Shi, Chiba Prefecture, Japan. **USA distributor:** Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.

at this point. Saito's standard choke slide is fit for cold starts, though, in practice, only a little choke (maximum quarter shut) was required, even at near-freezing temperatures. Both the main needle and choke slide can be fit with extension rods to suit a variety of models.

PERFORMANCE

As can be seen, the Saito 1.50S has a performance range that's wide enough to handle a considerable variety of propeller sizes. Following Saito's advice of approximately 60 minutes run-in period (including their suggested 20 minutes at around 4,000rpm max), it was possible to operate a lot of props of various sizes/loads—from the lightest 13x6 Top Flite to the heaviest 24x10 Airflow. Realistically, though, the 24x8 Zinger represented the lowest sensible and usable rpm of 4,748 with the silencer.

TEST 1

• **Open Exhaust.** Fuel—10 percent nitro, 20 percent ML70. Plug Saito P2.

Fuel and oil type and percentage is in line with the manufacturer's instructions, but, nevertheless, the question of which oil to use gets more exciting by the month. Carefully avoiding specifics, situations are now occurring where a particular manufacturer says, "Avoid using castor oil" for a particular engine and the relevant distributor in a distant foreign country states, "Use castor oil only." Well, not too much room for the middle-of-the road here! At the risk of being totally tedious, avoid heavy loads in the early period of engine operation, and certainly always avoid *any* over-lean fuel settings. These points are much more important than the decision (a marginal one at best) as to which oil to use. In the case of the 4-stroke model engine in particular, always swiftly richen the fuel settings from what appears to be any max rpm running. There's often a "flat-top" to the available "correct" max rpm setting, and therein lies a danger. For example, an engine may operate "flat out" at three needle settings—2, 2¼, and 2½ turns open—with almost no readable difference in rpm. In this case, run at the 2½ setting; that's the most reliable one. The two turns-open setting is critically near the point of over-leanness; in any case, it reduces the amount of oil flowing through the engine with zero advantage—other than possibly fuel con-

Weighing in at only 1 ounce more than the Saito 120, the result is a large, 24 percent increase of the torque/pound ratio, which must augur well for this new engine's success in R/C scale events worldwide.

sumption itself. The middle setting is almost equally dangerous because it has little safety margin to allow for a dropping fuel level, slight temporary blockage of fuel, etc.

Because the rpm are virtually identical with each of the three settings, the power levels are also identical, so there's almost no point in running the model 4-stroke at other than the richest end of that "flat-top," and even slightly richer still during early running in.

PERFORMANCE

The low-speed potential of the engine was rapidly confirmed during the torque tests, with 90 percent of maximum torque being available even at the lowest point scanned—4,224rpm. A marked decline in torque only became apparent past the 9,500rpm mark. Significantly then, the Saito advice is to "not operate engine above 10,500rpm." Maximum horsepower of 2.06 was reached at 9,820rpm. This is a lower value than the manufacturer claims, but realistically, it's in line with the lower rpm range of this large-capacity, single-cylinder unit. As suggested earlier, the 1.50S really does come into its own when harnessing that large reservoir of torque between 5,000 and 8,000rpm; it's there that comparisons should, if needed, be made with other engines.

TEST 2

• **Standard silencer.** Same fuel and plug as in Test 1.

In this configuration, the torque figures almost flattened out completely between 3,500 and 7,000rpm with only a 4 percent variation between those points. Below 5,000rpm, performance was even ahead of the open-exhaust standard. These findings showed the 1.50S to be a definite advance in 4-stroke flexibility with regard to the rpm bandwidth of usable performance, because there have been indications of some rpm inflexibility in my previous model-engine 4-stroke tests, particularly when compared with standard performance of many 2-stroke engines.

IDLING

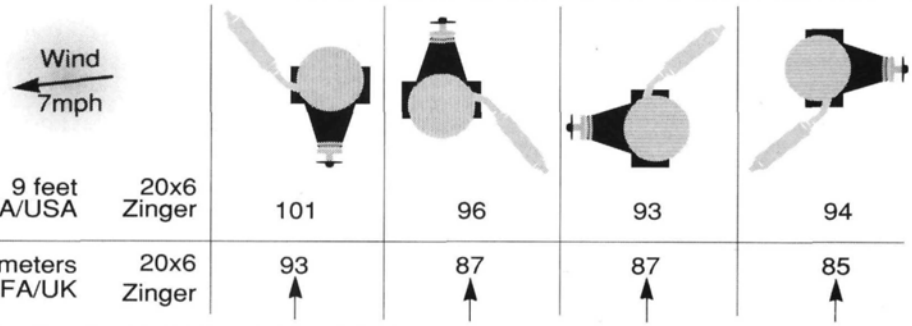
Using a 20x6 Zinger prop, a silencer and pressure feed to the fuel tank, long, slow-speed running down to 1,800rpm was obtained; this was followed by swift acceleration through the mid- to full-throttle settings.

SUMMARY

This manufacturer's total commitment to the 4-stroke principle probably gives them some sort of right to make advances in areas such as flexibility of performance and refinement of structure. My first impressions of the 1.50S were of a handsome, strong and well-constructed engine. Subsequent tests confirmed these feelings. Weighing in at only 1 ounce more than the Saito 120, the result is a large, 24 percent increase of the torque/pound ratio, which must augur well for this new engine's success in R/C scale events worldwide. Given its mechanical makeup, it's likely to be a predictable performer with long-term durability.

**Here's the address of the company that's featured in this article:*
***Saito,** distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.* ■

dB levels
Saito FA-1.50S (4-stroke)



9 feet AMA/USA	20x6 Zinger	101	96	93	94
7 meters BMFA/UK	20x6 Zinger	93	87	87	85

Engine: Saito FA-1.50S
Equipment: standard silencer
Fuel: 10 percent nitro
Temperature: 42° F
Location: outdoors, adjacent to farmland

Meter: Radio Shack (no. 33-2050) using GA601 calibrator set to NPL standard
Height: both meter and engine set 1 meter above concrete
Rpm: 7,020

IGNITION SYSTEM

(Continued from page 13)

• To deal with moisture, salt, corrosion and fungus, the circuitry is conformal-coated (painted with a military-spec silicon-resin lacquer).

• To deal with vibration, the circuit board is military spec, 60-mil fiberglass. All resistors, small-value capacitors, transistors and diodes are surface mounted (the same technology found in top-of-the-line servos). The electrolytic capacitors and integrated circuits are dipped, the DC to DC converter is glued onto the board with wiring "lashing" it into place, and the whole array is shrink-wrapped flat.

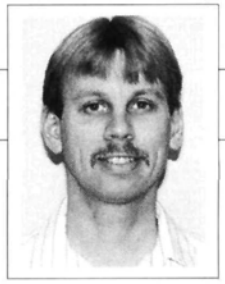
For convenience, ProSpark features Deans* connectors. Even though there are better and less expensive connectors on the market, they all require special crimping tools. Deans connectors allow average modelers to easily lengthen or shorten the leads to suit their installations.

With such a well-designed ignition system, I figured we were in safe hands and decided to test fly our $6,000, Aerrow 200-equipped Stiletto. The engine started with no trouble at all, and the 44-pound racer leaped off the runway and straight up in a dazzling display of unlimited vertical performance. We later clocked straight and level flight at an average upwind/downwind speed of 181mph!

ProSpark is only the latest miniature aircraft product to benefit from the rigors of giant-scale racing development, and I'm sure that we'll see many more such advances as the sport continues to grow. Although we refer to large racing engines in this article, ProSpark has been tested successfully in glow engines as small as a K&B* .61 2-stroke. Such engines reportedly can be run on gasoline with great efficiency. Although I have no direct experience testing such engines equipped with ProSpark, the reports

(Continued on page 99)

CENTER ON LIFT



MICHAEL LACHOWSKI

PREPARE FOR THE FLYING SEASON

I'M WRITING THIS on the winter solstice; the warmth of the holidays is making me think about the warmth of spring and the return of good flying weather, but don't rush to the field so quickly. I want to talk about checking out your sailplane before you toss it into the winds. If you have nice weather all year, it's time for an annual inspection of your old favorites, anyway. This month, I'll also talk about a new design—the Mirage from Weston Aerodesign*. And, it's time to plan that summer trip to the LSF Nationals.

THE MIRAGE

Last month, I talked about the Spectrum that I flew at the Tangerine this past November. There was one other really interesting new 2-meter design being flown for the first time—the Mirage from Weston Aerodesign. The Mirage's planform is quite similar to that of the Waco 2 with a triple-taper wing and a vee-tail. The styling is typical of all Waco designs: very narrow tip chords and a swept vee-tail. The Mirage has a very thin airfoil and is much lighter than most 2-meter designs. Even with a light wing loading, it has an excellent speed range, and it handled some of the windy conditions very well.

The Mirage is an example of a new trend: light models with thin airfoils. This combination has worked very well in the Monarch hand-launch design. The proper use of composites makes models such as the Mirage possible. Of course, a few pilots have been flying 8-percent and thinner airfoils in F3B for a few years now, so it's only natural to start seeing them in thermal designs.

Weston Aerodesign's construction techniques have evolved over the years; their original T-tail Magics only came in white. The Mirage and all the Waco designs are available pre-built and attractively finished in a variety of colors. They're an excellent choice for pilots who don't even want to finish sheeting the wings. I think Frank Weston has another winner with the Mirage.

Lubica Hoffmann displays the Waco Mirage. Lubica is one of the expert builders at Weston Aerodesign. The Mirage is Frank Weston's latest 2-meter design.

If you haven't seen the Waco Technical Newsletter, you should get a copy. The bimonthly newsletter contains great information about designing, constructing and flying high-performance sailplanes—not to mention a bit of humor and thought-provoking commentary. Volume II will also contain plans for the Waco 3. You can't beat all that information plus a set of plans for $20; for an additional $10, you can get a copy of Waco Design Software to help determine areas, stability, weight estimates, lay-up schedules and balance.

PREPARING FOR THE FLYING SEASON

It's springtime and time to get some more air time. Let's take a look at last year's model and do some tune-up work before taking it out to fly. Most of the work involves checking structural integrity and inspecting the control system.

Starting with the tail structure, flex the fuselage in front of the fin. Reflect some bright lights off the fuselage to check for cracks and uneven flexing. Next check the stabilizer mount. For bolt-on tails, check the bolt holes and the threads in the fin to see if they've been damaged or if they're loose. Plug-in stabs should have secure tubes in the stab and in the fuselage mount. Finally, check for any warps and twists in the surfaces and correct them.

Are the control surfaces OK? Check the hinges, and if you use tape hinges, look for cracks. Replace the tape if it's old or loose. Control horns should be secure without flexing. Look at the solder joints on any clevises. Finally, make sure that the control surfaces operate properly, and put some load on the surfaces. Move the pushrods, and see how the control surfaces respond. Be especially careful with the pushrods when pushing them against a load. After deflecting a control surface, you can easily manually force the surface back to neutral if the pushrod guide or the sheath is loose. Move the surface each way, and look at the neutral position to check for slop in the linkage and the servos. It's hard to fly a sailplane smoothly at a distance if your elevator doesn't center. Make sure that any bellcranks that are mounted inside the fin are secure.

Start checking the wings by looking at the wing mounts. Secure the tubes or boxes at all the joints between the wing panels and the fuselage. Inspect the joiner rods, especially if they're made of carbon fiber. Use good lighting to check for any signs of cracking. Now assemble the wings. Support the

tips, and flex the wing panels. Check the wing surface for any signs of sheeting buckling or delaminations. Flex the wings both ways and look at the top and the bottom. Other areas you should check are around the servo cutouts and the corners of the flaps. How straight is your wing? If the wing wasn't stored properly, there may be some warps that you need to correct. Sight down the wings to look for any problems.

Now look at the control surfaces. Many of the places to check are similar to those on the tail. Are the hinges secure? Replace loose tape hinges and distorted gap seals. Secure the control horns and the servo mounts. Loose servos and damaged control horns invite disaster. Look at the clevises and solder joints to make sure that the pushrods are OK. The hardest connections to check are the servo-wire solder joints. Flex the wire, and make sure that there aren't any breaks and that the heat-shrink tubing isn't the only thing maintaining the connection.

Turn on the radio, and make sure that the centers are good. Slowly operate all the servos, and listen for any clicks or misses that might indicate gear damage. Apply a light load to the control surface while doing this. Look for any binding in the linkages, and listen for excessive servo chatter from overloaded servos. You might want to measure your control-surface deflections, including a few intermediate points, so you'll know that everything is operating smoothly and evenly. Check for proper returns to neutral from deflections in both directions. Fix sloppy linkages and servos.

Check the areas around the wing mount in the fuselage. Watch for any cracks in the fuselage from "less-than-perfect" landings. Make sure that the servo tray is securely attached to both sides of the fuselage and that the pushrods can move freely. If you use pull/pull cables, make sure that the tension is correct and that there isn't excessive wear on the cable.

How's the tow-hook mount? The tow-hook shouldn't rotate or bend. Check the fuselage for warps. Even fiberglass fuselages can warp if you leave them leaning near a heat source. Sight down the inside of the fuselage to look for any loose parts or debris. A fuselage can be a comfortable place for mice. Assemble the model and check the CG, and secure any loose pieces used as weight in the nose.

RADIO CHECK

By now, you've checked all your servos. Remember that old servos may not perform or center well, so don't be afraid to replace them. It might be just the ticket to getting that old sailplane to fly like it did when it was new.

How many times have you heard that you should check the batteries? Check the capacity and all the connectors. Look at the switch, too. The contacts may be worn or corroded. Properly pack the receiver in foam. Look at the antenna wire, and check for any breaks. Make sure that the crystal is secure—especially if you like to change frequencies. There's nothing worse than having a crystal pop out on the zoom. If you have a computer radio, now is the time to make sure that you have a written copy of the program. Do some range checks, and get your frequency identification in proper order.

All this checking takes time, but it's certainly easier than building and trimming a new sailplane. I probably missed a few points, but I've covered the most frequent failures that can easily destroy a model. Down to the shop now.

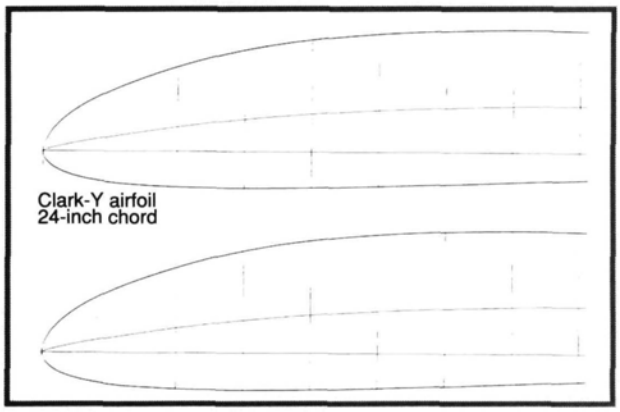
UPCOMING CONTESTS

The '94 LSF Nationals are shaping up for the week of August 6 to 13. This year, the event moves to Muncie, IN,

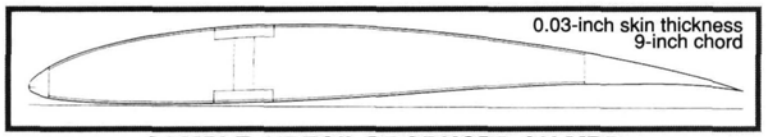
(Continued on page 99)

MODEL DESIGN

Chuck Anderson has updated his Model Design Program (MDP*) to version 4.0. You can use the program to generate wing plans and to plot all the ribs in a wing panel with spar locations. It can also plot airfoils, circles and ellipses for fuselage sections. MDP is a DOS program that works with a variety of dot-matrix printers and HP LaserJet printers. (I've had some luck using the LaserJet driver with my DeskJet 500C printer.) It has a nice menu and a form-based user interface. It's much easier to enter data in the newer version, and you can use a mouse with it.

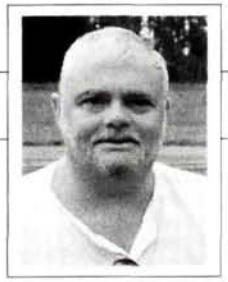


As a bonus, you'll receive Dave Squire's AFEDIT Airfoil Viewer and Editor program (see July '93 issue). An included installation program will help you to load the software on your computer. MDP with 42 airfoils is available for $50. The Pro version includes 140 airfoils and costs $75. Upgrades from version 3.0 are $15, and upgrades from earlier versions are $25.



SAMPLE AIRFOIL PRODUCED ON MDP

SPORTY SCALE TECHNIQUES



FRANK TIANO

A YEAR IN REVIEW

CAN YOU POSSIBLY imagine me being faced with a shortage of words? Nah, neither can I, but, for the life of me, I couldn't find the appropriate title for this month's column. I have a rather large file folder in my desk with the words "Sporty Scale" written across the top in thick, dark-blue, magic marker. This bulging file contains all the stuff I'm supposed to tell you about, all the new products that are available to us and a selection of scale airplanes that some of our readers have completed. The problem is that sometimes I have more material than the magazine has paper! So, what to do? Seems that the logical solution would be to: one—add a 13th month to the magazine; two—do a "Sporty Scale" special issue containing all this stuff; or, three—do a catch-up column, sorta like a past year in review or something. Whaddaya think? Well, if you're reading this, you've probably realized that number three got the nod.

Last year could have been the year of the Jug! There were a lot of P-47s sold and flown throughout the year. This fantastic example of a Yellow Aircraft P-47 belongs to Wild Bill McCallie out of Tampa, FL. At 24 pounds, it flies with authority on a Webra Bully or a SuperTigre* 3000. Bill likes the Moki* 1.8 as well.*

Garland Hamilton, one of the longest-serving Marines, and his Top Gun entry—a BVM T-33 with all the bells and whistles. Flaps, scale gear, brakes, speed brakes, power windows, cruise control and more! The Marine version has a lot more color.

Something very pretty, very unusual and very bizarre! This is the prototype of the racing plane that John Deere commissioned back in 1933 from Laird Turner (actually, a 1/3-scale model built for Tom Gruenebaum by Andy Bartosh from Pepino plans). Powered by a Husky 5.2-cuber, it weighed in at 44 pounds with a wing loading similar to that of a '66 Ford dump truck loaded with gravel! This model actually flew better inverted than upright because of an incorrect incidence measurement in the top wing. It now resides in Tom's garage—the far left corner—in a rather large plastic bag or three!

CATCHING UP

Over the past 12 to 15 months, we've been very fortunate in that our corner of the hobby market has been blessed with hundreds of new products, several of which are new aircraft designs. Radio manufacturers are finally realizing that scale models make up a very large portion of the modeling pie and, therefore, deserve gear designed around their specific needs. Engine manufacturers have come a long way in designing or altering powerplants specifically for model use, and the electronics people have done wonders by giving us better, bigger and more reliable batteries, chargers and measuring devices. The super reliability

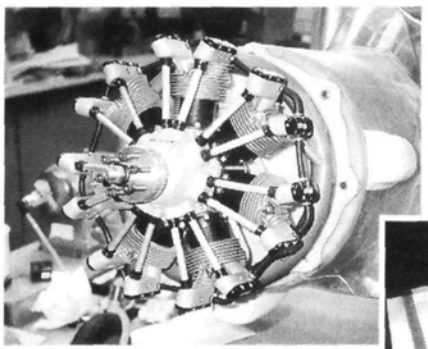
How about a medium bomber on floats that General Doolittle would really have fought for? Ralph Willett's Royal B-25 with two K&B.61s and Balsa USA* 48-inch floats. Weird? Yes. Neat? Definitely!*

of today's electronics and the brute horsepower available from some engines make almost any model subject capable of successful flight! Notice I said "almost."

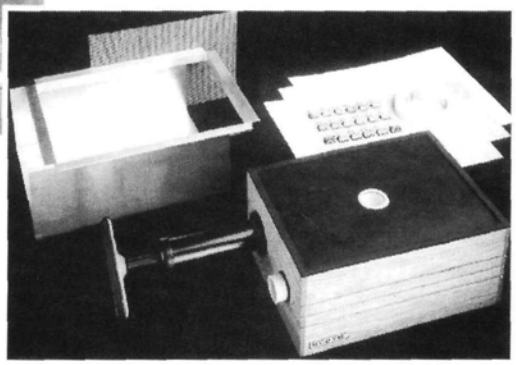
You saw it here first! Bob Violett Models' brand-new F-80 Shooting Star—the U.S. Air Force's first operational jet fighter just after its first flight at Deland, FL. The 80-inch model is a dream to fly, and it will be offered in the deluxe stage only, with a choice of optional tip-tank packages.

If someone were to try to place a name tag on the past year or so (you know, like the "Year of the __"), I would have several suggestions. They would include, but wouldn't be limited to, "The Year of the Turbine, the T-6, the Twin, the Radial, the 100-inch Airplane, the Zenoah, the O.S. 300, the Racing Airplane, the Jet, or the Super Contest." And let's face it: great arguments can be made for defending any of the aforementioned titles. In the past 15 months, there have been more plans sold than ever. Balsa sales have gone to the moon, and manufacturers are energetically producing scale kits once again! Blowing up a successful plan to the size we like has become commonplace.

Another bonus we scale enthusiasts have enjoyed is the sudden availability of all sorts of documentation. Several companies have doubled, and even tripled, the size of their catalogues of picture packs, three-views and reference books. Among the top are Bob Holman Plans*, Bob Banka's Scale Model Research* and Lyle (Jim) Pepino's Scale Plans and Photo Service*. Several new scale kits have finally reached the dealers' shelves. They include the fabulous new Midwest* T-6, the Byron* T-6, Top Flite's* Gold Edition P-51 and P-40, Yellow's* P-38, a virtual slew of Extras and Ultimates, Global's* Skyraider, Wayne Siewert's* KI-84 and, of course, Bob Violett's* new F-80 Shooting Star and F-4 Phantom. And how about the selection of new engines that have come our way? The new Robart* radial is outstanding, as is the new Zenoah* G-45, designed specifically for model airplane use. The geared Torquemaster G-62 from Bob Holman and the Saito* 1.50 4-stroke also come to mind. And right up there in the new plans releases are the A-26, Fairey Firefly, Tucano, KI-61 Tony and F7F Tigercat from Don Smith Plans* and the P-61 Black Widow, P-38, deHavilland Dash 8 and the Old Tiger from Nick Ziroli Plans*. Plus, there's a brand-new service offered by a not-so-new company that will generate a set of three-view drawings of your aircraft—all from a single photograph! Check out W.W. I Aeroplanes Inc.* for details. No, you don't have to be a baling-wire and multiple-wing freak to use their services.

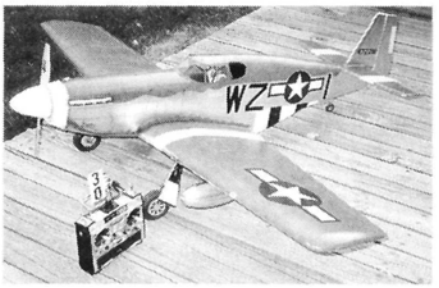


In 10 minutes, Dennis Crooks exchanged his G-62 for this Robart radial. This is the same T-6 that Dennis went on to fly at Madera after he changed back to the required G-62, of course. The T-6 features a Bridi fuselage with built-up wings and tail surfaces.*



Acc-U-Vac is a great new version of an age-old invention that now allows even a super klutz to make plastic parts out of simple plugs. Appian's second-stage vacuum is part of this do-it-yourself system. Acc-U-Vac costs under $170, and it's used in conjunction with your shop vac.

When Gary Madden is not cutting kits, he is designing Halloween costumes! Here's Gary's son, Jeff, all 4 years of him, in his latest ensemble made from cardboard. Jeff says he loves to go flying with his Dad, and the only maneuver he just can't do is a loop! See you at Top Gun in 2010, Jeff.



Bob Curry of Woodstock, NY, is becoming well-known both as a Top Gun static judge and for his ability to turn even a squint-scale model into a thing of beauty. Here's his latest—a Dynaflite fun-scale P-51 with an old Top Flite "B" canopy. It's covered with micafilm, weighs 7 pounds and uses an O.S.* 90 FS.*

And for all those little details you've

(Continued on page 112)

IGNITION SYSTEM

(Continued from page 85)

reflect still another capability of this remarkable new product.

[Editor's note: Dave Gierke will be testing the ProSpark in a smaller glow engine in the near future; stay tuned.]

**Here are the addresses of the companies mentioned in this article:*
***Aerrow Inc.,** P.O. Box 183, Perth, Ontario, Canada K7H 3E3.*
***ProSpark,** distributed by Cabral Systems Inc., 2459 S.E. Tualatin Valley Hwy., #465 Hillsboro, OR 97123-7919.*
***Webra;** distributed by Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821.*
***APC Props/Landing Products,** P.O. Box 938, Knights Landing, CA 95645.*
***Desert Aircraft,** P.O. Box 18038, Tucson, AZ 85731.*
***Lake Hobbies,** P.O. Box 2010, Sparks, NV 89432.*
***Moki,** distributed by Gerard Enterprises, W. 225 N. Eastmound Dr.,Waukesha, WI 53186.*
***Robart Mfg.,** P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*
***Deans Connectors;** distributed by Ace R/C, 116 W. 19th St., Box 511C, Higginsville, MO 64037.*
***K&B Mfg.,** 2100 College Dr., Lake Havasu City, AZ 86403.* ■

GRAUPNER BIENE

(Continued from page 40)

design. Given its simple assembly and excellent flight performance, I recommend it as a good first electric airplane. If you want to surprise your friends at the flying field with the length of time your electric can stay aloft on a single charge, equip a Biene with the Speed 600 Eco 7.2V motor, and give it a whirl.

**Here are the addresses of the companies mentioned in this article:*
***Hobby Lobby Intl.,** 5614 Franklin Pike Cir., Brentwood, TN 37027.*
***Oracover;** distributed by Hobby Lobby Intl. (address above).*
***Graupner;** distributed by Hobby Lobby Intl. (address above).*
***Stabilit Express;** distributed by Hobby Lobby Intl. (address above).*
***Gold-N-Rods;** distributed by Sullivan Products, P.O. Box 5166, Baltimore, MD 21224.*
***Sermos R/C Snap Connectors,** Cedar Corners Stn., Box 16787, Stamford, CT 06905.*
***Futaba Corp. of America,** 4 Studebaker, Irvine, CA 92718.*
***Cox Hobbies,** 350 W. Rincon St., Corona, CA 91720.* ■

CENTER ON LIFT

(Continued from page 88)

home of the AMA. The prospect for hand-launch golf looks good. A new nostalgia event will be added to the traditional thermal, F3B and F3J events. If you didn't attend last year, and you'd like an event calendar and entry applications, send an SASE to Mike Stump, 607 Washington St., Cadillac, MI 49601.

Another contest that's expanding is the Third Annual Mid-South Soaring Championships. This year, it will be held in Memphis, TN, from June 23 to 26. It will start with a 27-mile cross-country race on the 23rd, a hand-launch event on the 24th and thermal soaring on the weekend. Last year, more than 100 contestants attended,

(Continued on page 112)

CENTER ON LIFT

(Continued from page 99)

and this year should be even better. The event, which is organized by the Memphis Area Soaring Society and the North Alabama Silent Flyers, will also feature a vendor display area organized by event cosponsor *R/C Soaring Digest*. If you're interested, write to the Memphis Area Soaring Society, 1489 Wood Trail Cir., Cordova, TN 38018, or call Bob Sowder at (901) 757-5536.

**Here are the addresses of the companies mentioned in this article:*
Weston Aerodesign Co., *944 Placid Ct., Arnold, MD 21012; (410) 974-0968; fax (410) 757-8580.*
MDP, *P.O. Box 305, Tullahoma, TN 37388; (615) 455-6430.* ■

SPORTY SCALE

(Continued from page 92)

been just dying to vacuum-form, there's the new Acc-U-Vac, now available for home workshops from Appian Productions*. And those who like the plan designs but hate cutting out all those parts can buy custom kits of the Ziroli designs from The Aeroplane Works*. Don Smith's designs are being custom cut by Gary Madden* in upstate New York. Another bit of good—no, great news—is that Horizon Hobby Distributors* has uncovered a stash of Webra Bully parts that can be ordered through your favorite hobby shop. I know for a fact that they have carb parts, cranks, pistons, rings and assorted other stuff.

So, as they say, that was the year that was, is now and ever shall be through the eyes of "Sporty Scale." I'm so very happy that scale modeling has triumphed and has become a sport—not just a failed exercise. We'll talk to you soon; in the meantime, enjoy your hobby and spend some money and, don't forget, for the past year or so, your six has been cleared.

**Here are the addresses that are pertinent to this article:*
Bob Holman Plans, *P.O. Box 741, San Bernardino, CA 92492.*
Scale Model Research, *2334 Ticonderoga Way, Costa Mesa, CA 92626.*
Scale Plans and Photo Service, *3209 Madison Ave., Greensboro, NC 27403.*
Midwest Products Co., *400 S. Indiana St., P.O. Box 564, Hobart, IN 46342.*
Byron Originals, *P.O. Box 279, Ida Grove, IA 51445.*
Top Flite Models; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
Yellow Aircraft, *203 Massachusetts Ave., Lexington, MA 02173.*
Global Hobby Distributors, *10725 Ellis Ave., Fountain Valley, CA 92728.*
Wayne Siewert, *2740 31st Ave. S., Minneapolis, MN 55406.*
Bob Violett Models (BVM), *170 State Rd. 419, Winter Springs, FL 32708.*
Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174.*
Zenoah; *distributed by ISC Intl., P.O. Box 40116, Indianapolis, IN 46240.*

(Continued on page 120)

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

CONGRATULATIONS to Carl Mills, of Jacksonville, FL, for correctly identifying the February '94 mystery plane. The Junkers Ju 287 V1, RS-RA was built out of the components of three aircraft to expedite flight tests for the new, forward-swept-wing (FSW) format.

The aircraft flew 17 test flights. Although it didn't play an offensive role during WW II, its design and testing led the way to the now accepted concept of FSW aircraft designs. The test plane was powered by four Junkers Jumo 004B-1 axial-flow turbojets that were rated at approximately 2,000 pounds of static thrust. Its maximum speed at a 19,685-foot altitude was around 345mph.

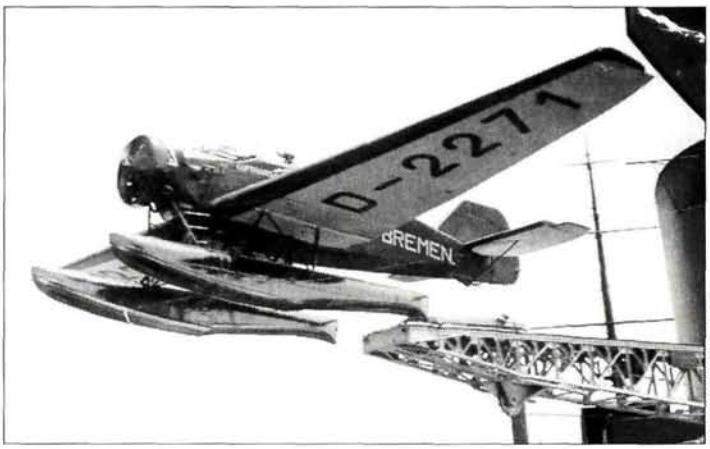


PHOTO COURTESY OF B. F. KIMMEL

The Junkers Ju 287 has a wingspan of 65 feet, 11¾ inches, was 60 feet, ½ inch long, and had an empty weight of 27,557 pounds and a gross weight of just less than 44,100 pounds.

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

CLUB OF THE MONTH

VINTAGE R/C SOCIETY
c/o John Worth, 4326 Andes Dr., Fairfax, VA 22030

The Vintage R/C Society's bimonthly newsletter is unique, easy to read and entertaining. Each issue gives you a lighthearted, nostalgic look at R/C in its early stages. Editor Art Schroeder (former editor of *Model Airplane News*) does a fine job of relaying "remember when" information.

In "Prez Sez," club president John Worth mentions that the development of narrow-band superhet equipment—which allows more channels of operation to be squeezed into a frequency—has changed the course of R/C; with more channels open, many can fly simultaneously. He writes, "Thirty to 40 years ago, we could fly one plane at a time. Remember when almost everybody operated on the same frequency—27.255 megacycles?"

The newsletter also recounts the first flight of club member Cliff Weirick with his U-control, .02-powered AJ Fireballs on 10- to 15-foot lines while he was on board the USS Kearsarge, CVA-33 from 1952 to '54. "Members' Corner" gives members a chance to voice their opinions and offer suggestions and ideas. In a two-part article titled, "John Worth's Secret System," John gives an extensive overview, including detailed isometric drawings, of ways to gain proportional control. "The Ad-vantage Point" column features favorite ads of yesteryear. One (circa mid-'60s, we believe) shows a Max-III 15 engine that sold for $11.98—$14.98 with throttle! What a bargain!

For their heartwarming look at the good ol' R/C days and for letting us relive them through their newsletter, we award the Vintage R/C Society two subscriptions to *Model Airplane News*. Congratulations! ■

SPORTY SCALE

(Continued from page 112)

Saito; *distributed by United Model Distributors, 301 Holbrook Dr., Wheeling, IL 60090.*
Don Smith Plans, *2260 N. Dixie Hwy., Boca Raton, FL 33431.*
Nick Ziroli Models, *29 Edgar Dr., Smithtown, NY 11787.*
W.W. I Aeroplanes Inc., *15 Crescent Rd., Poughkeepsie, NY 12601.*
Appian Productions Inc., *145 W. 58 St., New York, NY 10019.*
Aeroplane Works, *2134 Gilbridge Rd., Martinsville, NJ 08836.*
Gary Madden, *255A Horicon Ave., Brant Lake, NY 12815.*
Horizon Hobby Distributors, *4105 Fieldstone Rd., Champaign, IL 61821.*
O.S./Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Dynaflite, *P.O. Box 1011, San Marcos, CA 92079.*
Balsa USA, *P.O. Box 164, Marinette, WI 54143.*
Bridi Enterprises, *23625 Pineforest Ln., Harbor City, CA 90710.*
Webra; *distributed by Horizon Hobby Distributors (address above).*
SuperTigre/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Moki; *distributed by Gerard Enterprises, W. 226 N. 825 Eastmound Dr., Waukesha, WI.*
K&B Mfg. Inc., *2100 College Dr., Lake Havasu City, AZ 86403.* ■

AIRWAVES

(Continued from page 9)

Now there are two design features that promise to enhance model performance that we have written about in recent months that we haven't seen applied by modelers (because we just haven't been notified?): one was aerodynamic boost tabs (see Carl Risteen's articles on labor-saving devices for servos in the September and October '93 issues) and the other is belt-drive systems, whether for diesel, glow, or electric. If any of our readers have created designs or modified kits to use either of these features, please send photos of them to me for possible inclusion in "Pilot Projects"! TA

A LOST MEMBER

I thought I'd pass on an experience I had at a small flying field just south of Nashville, TN. The field is in a public park, and I arrived only as a spectator hoping to pick

(Continued on page 133)

by JEF RASKIN

THE PRINCETON AIRFOIL TESTS

Subject: *professional wind-tunnel tests of model airplane airfoils.*
Source: *John Donovan, 754 Stone Canyon Dr., Manchester, MO 63021.*
Summary: *an insider's view of the how's and why's of an exciting project.*
List price: *$24.95 in the U.S., $29.95 in other countries.*
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: *27 minutes.*

Here's an inside, detailed look at what it takes to do *real* testing of model airplane airfoils. The care with which these tests were done is astounding, and this video gives you a summary of the tests, a description of the apparatus, the test methods, an introduction to airfoil fundamentals and information on how to choose an airfoil. There's a lot of information in this tape.

One revealing test of a wing measures how much its lift increases as its angle of attack is increased. We get to see how a computer automatically draws a graph of this phenomenon as the wing model is slowly rotated to higher angles of attack. It's a slow process, taking a few minutes, but we watch the curve rise until it comes to the classic falling off of lift as the wing enters the stall. In practice, a single airfoil takes 1 hour and 45 minutes per curve! Measuring 60 airfoils at five Reynolds numbers each, counting all the false starts and other problems any careful experiment encounters, took more than 1,200 hours of wind-tunnel time. That's dedication. The results of these tests are no secret; they're available in the eighth volume of Herk Stokely's invaluable Soartech series, titled "Airfoils At Low Speeds."

The exciting news is that Michael Selig is starting a new series of tests. You can have your favorite airfoil tested, and the results will be made available to the world as the project goes on. You'll have to get the specs for making wind-tunnel models from Prof. Selig. If you do, I recommend that you make a donation to help them defray their costs.

If you're interested in the more aerodynamic side of our hobby or if you want to know what "instrumenting" and running a wind tunnel is really like (science-fair students take note), you have got to have this tape.

For information on ordering any or all of the Soartech issues, send an SASE to Herk Stokely, Editor, Soartech, 1504 Horseshoe Cir., Virginia Beach, VA 23451.

To find out about the new series of wind-tunnel tests and how you can help, send an SASE to Michael S. Selig, Asst. Prof. University of Illinois at Urbana—Champaign, Dept. of Aeronautical and Astronautical Engineering, 306 Talbot Laboratory, 104 S. Wright St., Urbana, IL 61801-2935, or send e-mail on the Internet to m-selig@uiuc.edu.

FLYING RADIO CONTROL MODELS

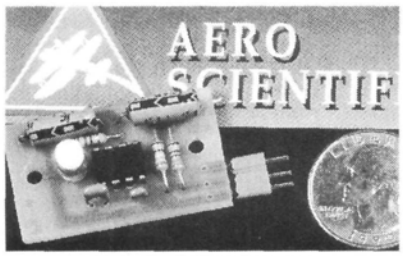
Subject: *advice to the neophyte flier.*
Source: *Zenith Aviation Books (800) 826-6600.*
Summary: *Dick Sarpolus shows us how to fly R/C.*
List price: *$39.95 (plus S&H).*
Rating: ✈ ✈ ✈ ✈ ✈
Approximate length: *60 minutes.*

This tape tells you what you would hear from an experienced, knowledgeable instructor—no gimmicks, no time wasted on extraneous matters, just a straightforward, professional presentation of flight basics. You won't know how to fly after watching it (no tape can do that), but you will know what you have to learn.

I do wish that Sarpolus, an award-winning AMA hall-of-famer, had taken a more conversational tone, but we can put this aside as he makes important points, including: a good trainer may have almost any kind of airfoil (some

(Continued on page 136)

PRODUCT NEWS



AERO SCIENTIFIC
NI-SPY IV

This tiny unit helps to protect your airplane by indicating when it's time to stop and recharge your receiver battery. An automatic self-tester shows whether NI-SPY is functioning properly, and built-in noise-reduction circuitry reduces the likelihood of false triggering. The unit comes with a mating connector and all mounting hardware.

Price—$19.95 (plus $3 S&H).

Aero Scientific Inc., P.O. Box 292, Grayslake, IL 60030; (708) 223-9066.

ASTROFLIGHT
Cobalt FAI-60-T

This high-powered motor is built on a solid titanium armature shaft that's 60 percent lighter than a stainless-steel shaft. It includes an asymmetrically machined magnetic ring. The endbell and the endcap are machined to further reduce the motor's weight and to allow air to cool the motor. The FAI-60-T features four heavy-duty brushes and AstroFlight's "TachStack" precision-trued armature stacks for improved balance and increased rpm.

Price—$499.

AstroFlight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242.

DREMEL
Super Moto-Tool Kit

Use this tool to cut, grind, drill and shape wood, metal and plastic. The Super Kit includes a handy flex-shaft attachment that puts all the power of the Moto-Tool into a pencil-thin, ½-inch-thick, cool-running hand piece that can be attached to the Moto-Tool with a 36-inch-long flexible cable. The carrying case has a tray to keep bits organized.

Part no.—3952; **price**—$99.

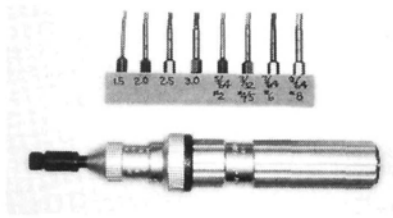
Dremel, Dept. RF, 4915 21st St., Racine, WI 53406; (800) 437-3635, ext. 2.

U.S. AIRCORE
CoroStar II

This .40 to .50-size sport/warbird is designed for more advanced pilots. Thanks to Fold & Fly™ Technology; Sword-in-Scabbard™ spar insertion; single-piece tail feathers; and one-part, No Sweat™ pushrods, the CoroStar II can be built very quickly. It can also be fitted with Explorer™ floats for use on water, snow and ice. Specifications: wingspan—56 inches; wing area—560 square inches; weight—5 pounds (RTF); engines recommended—.40 to .51 2-stroke, .48 to .53 4-stroke; radio—4-channel.

Kit no.—USA2110; **price**—$119.95.

U.S. AirCore Inc., 4576 Claire Chennault, Dallas, TX 75248; (214) 250-1914.

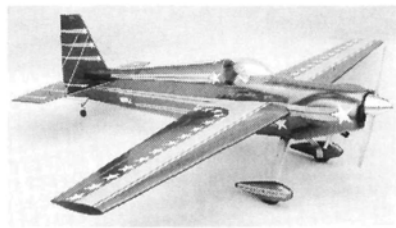


TORK-IT!
Precision Torque Screwdriver

This precision torque screwdriver has a micro-setting device that's adjustable from 2 to 36 in.-lb. An eight-piece bit set is also available with or without the screwdriver, or you may buy the bits individually. A 200 in.-lb. wrench for ¼-scale models is sold separately.

Part no.—Model 36; **prices**—$79.95 (screwdriver), $28 (bit set with screwdriver), $32 (bit set without screwdriver), $4 (each bit) (plus $3.65 S&H).

Tork-It!, 6048 Dee Ct., Stone Mountain, GA 30087; (404) 736-0916.



LANIER RC
⅓-Scale Laser 200

This kit contains all the balsa and die-cut ply parts needed to assemble the built-up fuselage quickly. The foam-core wings have sheeted leading and trailing edges. They're mounted on the fuselage on a hefty, aluminum-tube spar and can be easily removed when you want to transport the model. The kit also includes an ABS cowl; a full canopy; wheel pants; and formed, 6061 T6 aluminum landing gear. Specifications: wingspan—96 inches; wing area—1,596 square inches; fuselage—61 inches; weight—18 to 22 pounds; power requirements—3.2 to 4.2 2-stroke, 2.7 to 3.2 4-stroke.

Kit no.—94219; **price**—$379.95.

Lanier RC, P.O. Box 458, Oakwood, GA 30566; (404) 532-6401.

PRODUCT NEWS

WING MFG.
HP-200

This sport/stunt plane comes in a semi-kit that includes two plans sheets; foam wing-cores; a pre-shaped, foam turtle deck; a heavy, vacuum-formed cowl; wheel pants; a clear, one-piece canopy; formed-aluminum landing gear; heavy plywood main formers and firewall; a wing dihedral brace; and a list of additional wood needed to complete the airframe. Specifications: wingspan—80½ inches; flying weight—14 to 16 pounds; recommended engines—SuperTigre 3000, G-38, Quadra 42, or 1.20 to 1.60 4-stroke; radio—4-channel.

Price—$99.95.

Wing Mfg., 306 E. Simmons, Galesburg, IL 61401; (309) 342-3009.

CUSTOM CUTTERS
Variant II

This 87-inch-span, IMAA-legal, balsa and ply kit can be built quickly. All parts are machine-cut for accuracy, and the sticks and sheeting are hand-selected for strength and lightness. The kit includes a formed-aluminum main gear; a tail-wheel assembly with a tail wheel; and a complete hardware package. Specifications: wingspan—87 inches; length—65 inches; wing area—1,300 square inches; engine requirements—.90 2-stroke to S-3000.

Price—$169.95.

Custom Cutters, 4302 N. 750 W., Ligonier, IN 46767; (219) 894-3370.

JET MODEL PRODUCTS
T-33

This ⅙-scale jet kit is made entirely of molded fiberglass, and it comes 80 percent finished. All the visible panels have molded surface detail, including the wings, the fuselage, the ailerons, the flaps and all eight gear doors. The central bulkheads and landing-gear structure come installed, and each outboard wing and tip tank is a one-piece unit—easily attached or removed at the field. Specifications: wingspan—85 inches; length—76½ inches; weight—20 pounds; engine requirements—O.S. .91 engine with Dynamax ducted-fan unit.

Price—$1,895 (plus $40 S&H).

Jet Model Products, 211 N. Mullen Rd., Belton, MO 64012; (816) 331-0356; fax: (816) 331-3930.

NEW ZEALAND AERO PRODUCTS
Cessna Agwagon "B"

Aero Products offers new plans and parts packages to help you scratch-build the ¼-scale Cessna Agwagon "B." Available are full-size plans, three-views and documentation; a fiberglass cowl; wingtips; a tail cone; a canopy frame; landing-gear blisters; a hardware pack; and a wooden parts pack. Specifications: wingspan—123½ inches; engine size—1.5ci and larger. All parts and accessories are available separately.

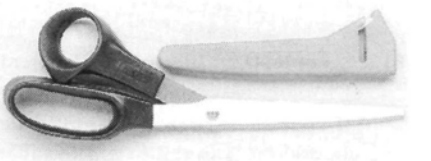
Price—$38 (plans, three-views and documentation).

New Zealand Aero Products, 34 Ward Parade, Stirling Point, Bluff, South Island, New Zealand; (03) 2128192.

MAKIN' MODELS
Pilot Figure

Makin' Models offers a complete line of pilots and cockpit-fabricating services. Each figure or bust is hand-painted and made of urethane resin. The molded cockpits are made of high-quality resin. They come assembled and painted and are available for most larger aircraft kits, including those of Byron Originals, Yellow Aircraft, Jet Model Products and Bob Violett Models. For more information, send $3 to:

Makin' Models, P.O. Box 328, Manhattan, IL 60442-0328; (815) 478-3531.



TOP FLITE
MonoKote Scissors

These scissors have precision-ground blades that practically slide through model coverings, paper patterns, fiberglass and more, leaving crisp, clean edges. The cambered blades meet at a point in the cutting area, so they won't pinch the material being cut. After just two or three passes through the included sharpener, the blades will be like new.

Part no.—TOPR2410; **price**—$12.99.

Great Planes Model Distributors, P.O. Box 9021; Champaign, IL 61826-9021; (217) 398-6300.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

Manufacturers! To have your products featured here, address the press releases to **Model Airplane News,** attention: Julie Soriano.

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This is correct. We hope this is sufficiently clear to make compliance easy! A corollary is that the minimum wing loading (20 ounces per square foot) for the heavier-wing-loaded internal-combustion class should be calculated with reference to the minimum-area mode. Also note that fans or rotors that are capable of pushing or pulling in both vertical and horizontal axes are not included in the wing-loading calculation. Thus, rotating nacelles, rotors on tilt wings, or rotors on craft such as Zimmer's Skimmer—all of which can motivate the aircraft in both vertical and horizontal axes—are not part of the wing loading calculation.

• ***Team entries.*** *Can a team enter this contest?*

We want the widest participation possible, and teams are clearly welcome.

• ***Backwards and descending flight.*** *Is a slow descent over the course, or is backwards flight, permitted?*

As for descending flight, we'd hate to see contestants trading in vertical speed to achieve apparent slow horizontal speed! Slow flight should be straight and level to the extent feasible and at an altitude of at least one wingspan. We will try to sort out the problem of weaving and bobbing by careful inspection of the videos. Weaving and bobbing must be minimized! Backwards flight is not part of this contest; trial flights should be made in winds that are below the speed of the aircraft, or, ideally, in dead air. Reversing direction in the course of a pass to prolong the time spent in making that pass is not allowed. Contestants are required to fly an upwind and a downwind course, and they should seek atmospheric conditions that minimize the presence of side wind.

• ***Wing loadings between 15 and 20 ounces per square foot.*** *In the internal-combustion classes, wing loadings must be 15 ounces per square foot or below, or 20 ounces per square foot or above. What if an airplane has a 17-ounce wing loading, i.e., between the specified 15 ounces or lower, and 20 ounces or higher?*

We chose the stated wing-loading categories to ensure that the "floater" and "conventional" classes would be distinct and different categories of competition. Wing loadings in between are defined out of the contest.

• ***Total displacement.*** *Is the .40 to .50ci displacement per engine or for all engines?*

The internal-combustion classes require a total displacement of between .40 and .50ci, whether you use one or more engines.

• ***Electric motors in internal-combustion classes.*** *Can the internal-combustion classes use auxiliary electric motors?*

Yes. There is an obvious weight penalty, but we believe the possibilities become more interesting if, in addition to the required cubic-inch displacement, we allow the use of auxiliary motors, whether for propulsion, stability, servo actuation or other use.

• ***Indoor electric high speed.*** *Is an indoor electric supposed to make a high-speed run in this contest?*

We think it is impractical to fly a model at anything but very slow speeds in a regulation, professional basketball-size gym, so there is no high-speed requirement. If two models were tied for slow speed, and one demonstrated an outdoor high-speed capability, the judges could take this into consideration in determining which model should receive the edge, but they are not asked to do so.

• ***Contest director and club president equivalents.*** *What should I do if I don't belong to a club, or there isn't one in the area to supply the CD and president who are supposed to sign a letter that they observed the slow-flight performance claimed?*

You'll have to find a couple of adults who wish to substitute for the CD and club president. Give me a call if you have any questions. We are just looking for some corroboration from responsible parties.

• ***Be prepared to provide an article.*** *What is the requirement for writing an article, and why is it part of the contest?*

We want to share the winning designs with our readers. Being prepared to provide an article is one of the contest requirements. We feel it is reasonable to ask contestants to take some black-and-white photos of the aircraft during the building process, and to be prepared to provide full-size drawings (they don't have to be professionally done; we can take care of that) and other components of a construction article, e.g., a concise written description of the building steps. Beyond the prize money, we will fully compensate authors of such articles (our fees are competitive in the industry) and will want the right to sell the plans in perpetuity. We will not own any design or kit rights (these are retained by the designer), but only a restricted right to sell plans. In this fashion, readers get the chance to build winning designs, and the designs will become part of the *Model Airplane News* plans library and, hence, part of the modeling heritage that can be enjoyed by future generations.

• ***Entry packages.*** *When entering the contest, to whom do I submit a package of information and the videotape?*

Please send it to the attention of Julie Soriano at the address noted below. Please write "Slow Flight Design Contest" on the outside of the package.

For a copy of the rules as published to date, contact Julie Soriano, Managing Editor, *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. If you have specific questions relating to the contest, contact me at (203) 834-2900; fax (203) 762-9803; Internet address: toma@airage.com. ■

AIRWAVES

(Continued from page 120)

up a bit of experience by watching accomplished fliers. (I am a rank beginner and have *a lot* to learn.) When I arrived, there was only one modeler there with a student pilot. I did not want to disturb them as they were flying a high-wing trainer, so I stayed behind them in the spectator area. I got a big kick out of watching them do touch and go's!

Less than five minutes after I arrived, one of them asked me whether I had an AMA card. I politely pointed out that one only needs an AMA membership card when one is actually flying a model (for insurance reasons). A notice to this effect was posted on a bulletin board right behind me in the spectator area along with some very sensible flying rules. This person kept insisting that I had to show him my AMA card; he said that if I didn't have a card, he'd call the police and have me thrown out of the park! When the police officer arrived, I explained the rules posted on the bulletin board, and the officer told the irate modeler that he couldn't arrest me for being a spectator!

In my opinion, this is the type of incident that gives the AMA a bad reputation. A few modelers think they can call all the shots—even at a public park where everyone has access to the flying field. If I remember correctly, we fly model airplanes for fun! Needless to say, after leaving the park, I pulled my AMA card out of my wallet, neatly cut it in half and beat feet to join the Sport Flyers Association. I'm out to fly only for fun.

E.D.
Nashville, TN

E.D., we all have had the experience of running into a self-centered, pompous person who seems out to ruin one's day. We all have to deal with one another one-to-one, and we should avoid falling into the trap of labeling an entire group or organization in a particular way because of the actions of a few myopic prop nuts. I'm sad that you cut yourself off from the good people in the AMA just because of a single adverse encounter. I'm also pleased you didn't leave the hobby completely, but found a new home with the SFA. The modeler who tried to have you arrested obviously misunderstood his club's flying rules. Good luck with your new organization! GY

BEAVER HUNT

n your December '93 "Pilot Projects," you howed a deHavilland Beaver Bushplane on loats. The model was said to have been uilt from a Unionville kit. I have been ooking for a Beaver in about this scale for

(Continued on page 136)

CLASSIFIEDS

RATES: non-commercial—25 cents per word. No charge for name and address (no commercial ads of any kind accepted at this rate); commercial— 50 cents per word (applies to retailers, manufacturers, etc.); count all initials, numbers, name and address, city, state, zip code and phone number. **All ads must be paid for in advance.**

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WANTED: *model engines and race cars before 1950.* Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [6/94]

WANTED: your old proportional radios; interested in pre-1980, American made; C&S, Deans, Klinetronics Spar and others. Older is better. Ron Gwara, 21 Circle Dr., Waverly, NY 14892; (607) 565-7486. [9/94]

WANTED: *model-airplane engines and model race cars made before 1950.* Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649. [6/94]

MISSILE SECRETS—engines, rockets. U-build. $2. Northtech-A5, 813 Cherry Ave., Albany, GA 31710

WANTED: *old engine parts, misc. junk before 1970.* Wesley Pettinger, 1501 Banbury Ct., Richardson, TX 75082; (214) 669-4003. [7/94]

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE:100 pages–timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 post-paid, U.S.; $20, foreign. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078. [8/94]

NEW ZEALAND AERO PRODUCTS—Scale plans: Agwagon, Pawnee, Pawnee Brave, Airtruk/Skyfarmer, Fletcher FU-24, Aerobat, Hall's Springfield Bulldog, Typhoon, DC-3/C-47, Fairchild PT-19/Fleet PT-26 and more. Fiberglass parts; hardware packs; timber packs; color photo packs available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand; (03) 212-8192. [2/95]

SCALE DOCUMENTATION-MODEL PLANS—Drawings, photo packs, monographs, unusual aircraft. Illustrated catalogue: $2 (post-paid). Bill Young, 8106 Teesdale, N. Hollywood, CA 91605. [4/94]

HELICOPTER SCHOOL—five days of hands-on instruction with X-Cell helicopters and Futuba computer radios. Small classes tailored to your individual needs. Beginner to expert. Includes all meals and lodging. Over 300 satisfied students and 10,000 flights logged. Located on a 67-acre airport used exclusively for R/C training; owned and operated by Ernie Huber, five-time National Helicopter Champion and helicopter designer. Send for free information and class schedule *now!* R/C Flight Training Center, P.O. Box 727, Crescent City, FL 32112-0727, or call (800) 452-1677. Outside USA: (904) 698-4275, or fax (904) 698-4724. [6/94]

ANTIQUE AIRPLANE PRINTS, 8x10 color prints. Stearman, Gee Bee, Waco, Jenny, P.T. Ryan; 10 in all. Send $1 (refundable) for color brochure. Robert Kohr, P.O. Box 204, York, PA 17405. [5/94]

SALE—kits: wood, plastic; ignition engines; parts and mags (pre-1965). Specify needs. Send SASE and 60 cents for list. Leonard Roberts, 3819 Lydon Ln., Moosic, PA 18507; (717) 961-2357. [12/94]

CUSTOM KIT BUILDING. Will build most kits from trainers to quarter scale; 20 years experience. Write for quotes: Midwest Model Factory, 280060 Highland Rd., Minatare, NE 69356. [5/94]

WANTED: built or partially built Ercoupes, Cessna 150, 152, 172, 182, Grumman American Tiger (AA5), American Yankee (AA1), or Mooney M-10 Cadet. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; (714) 768-0585. [11/94]

PLANS ENLARGED. Scanning/plotting services; model designer's computer software; free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

MAKE REAL DECALS with your computer and printer! Send $10 for starter kit and instructions to LABCO, 27563 Dover, Warren, MI 48093-4764. [5/94]

GIANT-SCALE PLANS by Hostetler. Send SASE to Wendell Hostetler's Plans, 1041 B Heatherwood, Orrville, OH 44667. [11/94]

WANTED—*CONTROL-LINE* profile kits: Midwest P-63, Skyraider, P-51, ME-109, Sterling Navion, Starfire, Skyshark, P-40, Sportster. Throttles: Rotovalve, Dynamic 19/60, McCoy 19/35 RD/BL, K&B 19/35 grn. Engines: McCoy 19/35 R/C RD/BL, three-line bellcranks. Paul Patterer, 114 Mosher Ave., Battle Creek, MI 49017; (616) 965-5364. [3/94]

ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [5/94]

ARE YOU TIRED OF PAYING $1.29 for six screws? For a *free* catalogue and price list of screws, nuts, locknuts, blind nuts and more, in sizes from 0-80 to ¼ inch, contact Micro Fasteners, 110 Hillcrest Rd., Flemington, NJ 08822; (800) 892-6917; fax (908) 788-2607. [5/94]

MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [9/94]

NEW TO R/C? Try this booklet—Selecting, Building, Flying Your *First* Radio Model—$4, including postage. Dr. Little, #1 E. University Pkwy., #209, Baltimore, MD 21218. [5/94]

WANTED: Sterling discontinued Ansaldo SVA5 kit no. A-18; Spad XIII kit no. A-21; Guillow's discontinued Pfaltz D-3 kit. Collector will pay top prices. George Santikian, 7285 N. Channing, Fresno, CA 93711; (209) 439-3363. [5/94]

R/C SKYDIVING—illustrated catalogue: $1. R/C Skydivers, Box 662N, St. Croix Falls, WI 54024. [7/94]

FOR SALE: *fiberglass B-17, B-25, B-26—molds and parts. Everything* must go! Asking $3,500. Call Don at (407) 676-4123. [5/94]

R/C SWAP MEET in your living room! Nationwide buy/sell/trade newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [5/94]

PROMOTION—*free biplane sport-scale plans.* Send address: Sibille Concept, 272 Royal, Gatineau, Quebec, Canada J8T 8E5. [4/94]

MODEL HOT-AIR BALLOONS. Fly thousands of feet high; visible for miles at night; build for pennies each. Photo-illustrated instructions. Send $5 to Air-Crafts, Dept. B, 62 S. Gate Dr., Poughkeepsie, NY 12601. [5/94]

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ANTIQUE IGNITION engine parts: excellent reproductions, fuel tanks, points, timers, coils, needle valves, gaskets, etc. Champion spark plugs. Catalogue—$5 (intl. airmail—$7). Aero-Electric, 1301 W. Lafayette St., Sturgis, MI 49091. [8/94]

WANTED: ignition model engines 1930s to 1950s, especially Elf, Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc.; Woody Bartelt, 1301 W. Lafayette St., Sturgis, MI 49091; (616) 665-9693, or (800) 982-5464. [8/94]

LOCKHEED P-38 LIGHTNING. If P-38s—R/C scale models or full size—are your *thing*, join the P-38 Model Organization International—a worldwide association for P-38 enthusiasts. For more information, send $1 to P-38 M.O.I. Medelbyvej 54 DK 2610 Rodovre, Copenhagen, Denmark.

PC PERFORMANCE: easy-to-use, menu-driven computer program predicts flight performance of R/C model aircraft. For IBM PC compatibles with monochrome or color-graphics capability. Introductory price—$15 (plus $3 S&H). Specify disk format. Softair, 10710 Evergreen Way #D305, Everett, WA 98204. [5/94]

SOFT XMITR control-stick pads. Custom look, non-slip covers—feel comfortable. For information, send SASE to Amertech, P.O. Box 9233, Wichita, KS 67277. [5/94]

SCALE DOCUMENTATION and resource guide. Larger, updated 1994 Edition. World's largest commercial aircraft collection. Over 5,000 different color FOTO-PAAKS and 25,000 three-view drawings; 152-page resource guide/catalogue—$6 (Canada—$7; foreign—$12). Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058. [8/94]

INTERNATIONAL AIRCRAFT RESEARCH: need documentation? Include name of aircraft for availability of documentation, with $3 for photo and three-view catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J 3G3. [9/94]

MAKE EXTRA CASH FOR YOUR HOBBIES. Do it at home. It's easy! Send $2 with SASE to Cash Concepts, 1973 Nellis Blvd. Dept 356, Las Vegas, NV 89115. [6/94]

PAPER AIRPLANE BOOKLET. 20 unique and original paper airplanes. Great for the kids. Send $5 to: Richard Krebs, 639 West Oakland Park Blvd., Ft. Lauderdale, FL 33311. [5/94]

ENGINE TEST STAND with BHP dynamometer and thrust readout. For large and small airplanes, jet and rocket engines. Inexpensive planes $10; 2315 Mahoning Road N.E. Apt. #1, Canton, OH 44705-1913. [5/94]

ENGINES FOR SALE: new, used, early and late glows. Some with carbs and mufflers. SASE for list: Joel Balsam, 4 Pickwick Hill Dr., Huntington Station, New York, NY 11746-1241. [5/94]

I BUY GI JOE. I fly R/C but collect GI Joe. If you have any that you'd like to part with, call me. Thanks. Jeff Gilbert, (815) 875-4611 [4/94]

WANTED! November 1940 issue of *Model Airplane News* complete, contact: S.A. Lindberg, 115 Del Oro Circle, Colorado Springs, CO 80919. [6/94]

R/C SWAPMEET IN YOUR LIVING ROOM! Nationwide buy/sell/trade newsletter with fast circulation. Free sample copy. R/C Trader, P.O. Box 145, Big Lake, MN 55309; (612) 295-7521. [4/94]

FIBERGLASS WW II BOMBER MOLDS. $1,500 for everything. Ask for Don: (407) 676-4123. [5/94]

SCRATCH-BUILDERS WANTED to work part-time at home assisting with completion and flight testing of composite kits. Need experience in one of the following: Q-500, giant-scale sport 100-inch+ span, sailplane 144-inch+ span. Write to Scratch-builder, P.O. Box 6165, Philadelphia, PA 19115. [5/94]

WW I PLANS—Peanut to 100 inches. Send two $1 bills for illustrated catalogue to: Clark Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [3/95]

MAGAZINE BACK ISSUES—Flying Aces, Model Airplane News, Air Trails, 1930s and '40s. FM, RCM and more. Send SASE for list to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [9/94]

P-38 LIGHTNING, COLUMBIA MODEL WORKS KIT. 95-inch wingspan, SuperTigre 2500's, Robart retracts, Futaba radio. Everything new. Never been flown. Will crate and ship. $2,800; Lasalle, IL; (815) 223-6783. [5/94]

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MAGAZINES—50 *Old Timers* (22 pounds): $50; 244 *Model Builders:* 1971-1991 (3x40 pounds): $125. Send SASE for list. George Wilson, 82 Frazier Way, Marstons Mills, MA 02648. [5/94]

WANTED: *Saito 80 head, new or used.* Andre Landrum, 524 Sycamore Circle, Ridgeland, MS 39157; (601) 856-2339. [5/94]

PAYING $50 each for toy metal outboard boat motors—Mercury, Evinrude, Gale, Oliver, Scott, Johnson. Ship for immediate payment, or call (616) 941-2111; Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49684. [8/94]

WANTED—single-channel, pulse proportional system—any frequency; ideally, Ace Pulse Commander baby or baby twin, in good condition. Also plans and castings for good, 60-size spark-ignition engine. Fred Burman, 28 Douglas St., Nowra, NSW Australia, 2541. [5/94]

MODEL GRAPHICS/VINYL LETTERING—Introducing new 20-page *instructional catalogue and model decorating guide. Special offer: any* combination of 10, 2-inch letters or numbers, custom-cut and ready to install, with catalogue—$4.95. Graphics A.M.P. Inc., 42a Nancy St., W. Babylon, NY 11704; (516) 253-2702. [7/94]

"VACUUM FORMING." This 128-page illustrated book shows how to make light plastic parts. Get professional results with low-cost equipment. Over 7,000 copies sold. Try it for yourself—$9.95 (plus $1.06 S&H). Coming this fall: complete machines, components and supplies. Vacuum Form, 272 Morganhill Dr., Lake Orion, MI 48360; (800) 391-2974. [5/94]

FOR SALE—*Model Builder* magazine collection, published by Bill Northrop, Jr.—issues no. 1 through no. 173, except issue no. 122; first 10 years in binders—all excellent condition. Sell to best offer received by June 30, 1994. Duplicate issues of above; 1976 and 1977 complete; 47 additional issues. SASE for list. Engine collectors journal, Vols. 1 through 14 sold as lot (B/O as above). Meca Bulletins, no. 1 through 80, sold as lot (B/O as above). Shipping additional. Howard Carman, 7 Claire Dr., Hilton Head Island, SC 29928-3937. [5/94]

SMOOSHIE BAILS OUT! Release a scale-like parachutist!—a real crowd pleaser and a lot of fun! For a brochure, send SASE to Hobby Hut Mfg., 2040 W. 21st. N., Ste. 77, Wichita, KS 67203-2107 (Dept MAN). [10/94]

VACUUM-FORMING MACHINES—from the leaders in low-cost vacuum-forming. Three powerful machines engineered for the hobbyist: 6x9 in.(sheet size)—$59; 9x12 in.—$89; 12x18 in.—$129. All have two-stage vacuum systems providing up to 28 in. of vacuum (five times more powerful than a vacuum cleaner). Featuring a seamless, molded, forming surface—no joints or gaskets; no leaks. Optional plug-in adapters use smaller sheets. High-quality modular construction lets you upgrade as you go. Choose from four vacuum pumps—$12.99 to $129—also books, plastic sheets and components. Beware of imitations! Compare before you buy; 5-year warranty; 30-day money-back guarantee. Vacuum Form, 272B Morganhill Dr., Lake Orion, MI 48360; (800) 391-2974. [5/94]

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[9/94]

Send sales message and payment to:
Model Airplane News, Hobby Shop Directory,
251 Danbury Rd., Wilton, CT 06897.
For more information, call toll-free (800) 243-6685 and ask for Arlene Melko.

AIRWAVES

(Continued from page 133)

quite a while. Do you have the company's address? I actually flew on two of Ketchum Air Service's Beavers, so when I saw the plane in your magazine, I was pleasantly surprised. I would appreciate any help you can offer. Also, are there any 9-cylinder radial engines in the correct size for this model?

JAMES FRANKENBERG
Lula, GA

Jim, because of "Big Alaskan Beaver," we received many requests for Unionville Hobby Supply's address; in fact, this model (built by Ray Agen of Anchorage, AK) won third place in our 1993 "Pilot Projects" contest. With the addition of flaps, landing lights and a fully detailed interior, the Unionville kit makes a very impressive project.

The only 9-cylinder engine I'm aware of is the Seidel, sold by Proctor Enterprises. (Can readers help? Let us know.) That is a 5.5hp engine with an 11-inch diameter—a bit oversized for your application! Technopower offers a wonderful, reliable 7-cylinder engine that's very popular with scale modelers who are interested in round engines. The 7-cylinder engine weighs 30.5 ounces, has a 2ci displacement and a 6.625-inch diameter. It should supply more than enough power for a Unionville Beaver. Contact Unionville Hobby Supply, P.O. Box 135, Markham, Ontario, Canada L3P 3J5; (905) 884-1683 (ask for Joe Murray). For the 7-cylinder engine, contact Technopower II Inc., 610 North St., Chagrin Falls, OH 44022; (216) 564-9787. Readers who want more info on the 9-cylinder Seidel should contact Proctor Enterprises, 25450 N.W. Eilers Rd., Aurora, OR 97002. GY

VIDEO VIEWS

(Continued from page 129)

writers have unfortunately claimed that flat-bottomed airfoils are always better); size is not as important as having a model in which the engine is well-matched to the plane—even a .049-powered sailplane can make a good trainer (though the conventional .40 to .60 is preferred, especially when taking off from grass); there's no need to be doctrinaire on how to hold a transmitter—do what is comfortable (but he prefers to use two fingers on the sticks rather than the thumb).

The tape is a bit dated (Kraft equipment, no eye or ear protection, and computer simulators aren't mentioned as a learning aid) but flying is flying, and the explanations o

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VIDEO VIEWS

(Continued from page 136)

how a plane turns and should be flown are right on. The flying is expert and sets a good example.

Sarpolus describes elevator stick motion as "up" and "down," which gets a lot of us into trouble because we're trapped into saying that moving the stick up moves the elevator down and vice versa. This can be confusing to beginners. It's better to position the transmitter horizontally and speak of "pushing" and "pulling" on the stick—terminology that doesn't have to be abandoned when the student later learns to fly inverted.

In that the methods shown are applicable to flying almost any R/C model, this video is, by a little bit, the best instructional video yet to be reviewed in this column. A beginner who watches it will be well-prepared to learn how to fly from a live instructor. ■

ADVERTISER INDEX